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FACTORS CONTRIBUTING TO FACIAL GROWTH AND DEVELOPMENT

THE INHERENT FACTORS TO BE CONSIDERED

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IN A SERIES of three papers we shall attempt to clarify and correlate factors that contribute to the development of the face, the jaws, and the teeth. An effort will be made to present each factor in its logical sequence, explaining its contributions to facial development, its interdependency, and how one or more factors may be nullified or perverted by anomalies, bad habits, poor dentistry, ill health, or almost any combination of these causes.

If dentistry is to be a science worthy of the name, we, the dentists, must have an understanding of the biologic, physiologic, and functional contributions to the building of the field in which we work. This is a broad subject and will necessitate some repetition for emphasis. In the last paper an explanation of the practical value of what has preceded should be interesting as well as instructive. Every orthodontist can make use of this in his daily practice, with great satisfaction in being better able to recognize either normal or abnormal growth and development. Such knowledge and its application are prerequisites to the practice of orthodontics.

We feel it is better, for the sake of clarity, not to include constitutional disorders in this discussion, since they are chiefly problems of the medical profession and have a gradient effect depending on the individual's constitution, severity of the case, and time of onset. Nevertheless a few accepted general facts and theories in regard to constitutional disorders seem necessary. Since growth takes place in waves, and possibly not all growth centers are active at the same time, we can see that the kind and degree of deformity resulting from

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a constitutional disorder is apparently conditioned by the time of onset. Brodie[1] writes, "It is possible that an adverse constitutional factor working on two simultaneously active growth centers will affect one and not the other."

If one may judge from the research done on nutrition, diet may be a disturbing factor, arresting the developmental pattern and causing the deposition of a quality of bone that may be deformed by the normal forces it was intended to withstand.

A constitutional disorder does not always result in underdevelopment, but may lead to an overdevelopment, as in acromegaly. The endocrines may affect growth and development in many ways, few of which are well understood at this time.

From the work of the late T. Wingate Todd[2] and his associates of Western Reserve University, we learn that, "acute illnesses in childhood do check growth temporarily, but do not materially affect the increment of growth during a six- to twelve-month period, whereas a child handicapped by a chronic disability such as hypothyroidism, or severe allergy, does not achieve the expected increment in stature. Month by month and year by year, he falls farther and farther behind."

Since the more severe the constitutional disorders are in childhood, the further from normal will be the other factors that influence growth and development; therefore our analysis of facial development must be confined to the normal responses of the tissues and organs in normal function.

In the past many perversions in shape and form were blamed on heredity. Today many of these perversions are better explained as a result of disturbed growth and development or lack of proper function. Our present conception of heredity seems to be that there is no transmission of unit characteristics as the simple mendelian inheritance with its dominance, recessiveness, and segregations, but rather a gradual blending or harmonious adjustment of the characteristics of the parents and the ancestors. In other words, is it logical to conclude that an offspring may inherit the large teeth of one parent and the small jaws of the other? According to Hrdlicka,[9] skeletal material seems to verify this, but these assumptions have not been substantiated by scientific determinations.

This does not dismiss heredity from our discussion, but limits it to what is known as the hereditary pattern—the transmission of the characteristics of a race down through the ages, modified by environmental changes and interbreeding of the races.

According to Drs. Noyes, Schour, and Noyes,[3] "Heredity gives each individual structural unit the urge to develop a form characteristic of the species and the individual. A mandible tends to become a mandible even though it be removed from the animal to which it belongs and is grown in an implanted position in another animal. Each bone, each tooth, as well as each muscle and gland, has a growth pattern which it tends to fulfill. The extent to which each ultimately fulfills its potentiality is dependent upon the nature and degree of coordination in the growth and development of the whole being and upon the environment to which the units are subjected, both collectively and individually."

Since each unit of the whole has a hereditary growth pattern, and there is usually a harmonious relation between each unit as to type, function furnishes

the stimulus for further growth and development beyond the influence of the hereditary growth pattern.

For a mutual understanding we classify teeth according to types, namely tapering, ovoid, and square. These types are merely approximations, and there are all gradations between these general types. The tapering tooth has a long crown, well-defined contact points, high cusps with steep, inclined planes, while the square tooth has a short crown in proportion to width, with low cusps, and shallow grooves and fissures. Each type is associated with facial form of the same type, and since heredity determines tooth form and the relation of the crown to the root, and tooth form determines arch form, we may say that arch form is also inherited. The height of the cusps and the pitch of the inclined planes necessitate a masticatory stroke that tends to maintain this arch form. It is not sufficient to say that tooth form is inherited, but rather the individual tooth's form within each type. Each tooth is so shaped as to give it the greatest mechanical advantages for the functions it must perform. For example, the wide lingual surface on the root of the maxillary central incisor. The greatest stress on this tooth when functioning is in a labial direction, and since the peridental membrane suspends the tooth in the socket, rather than acts as a cushion, this broad root surface affords attachment for a greater number of the fibers of the peridental membrane. This type of analysis can be made of the design of each tooth in the denture. The maximum bone development around every tooth is on the side of the greatest pull of the peridental membrane. From this we see that each tooth is responsible for the development of the bone that surrounds it and the effect on facial development of the loss of a tooth during the growing period.

Growth and development have their beginning with the individual cell. As Downs[4] so aptly expresses it: "The growth and development of the denture and the face is a complex process, requiring about twenty years to reach maturity. In the last analysis the complexity of the picture is due to the delicate response of cells to the stimuli of metabolic growth forces, functional demands, and various extraneous forces." Growth and development are two distinct forces that may work separately somewhat, but working together give full expression to their potentialities. To prevent confusion, we may define growth as increase in size and development as progress toward the characteristic form and function of maturity. According to Weismann,[5] "The body protoplasm, or soma, and the reproductive protoplasm differ fundamentally. The germinal material is a legacy that has existed since the beginning of life, from which representative portions are passed on intact from one generation to the next. Around this germ-plasm there develops in each successive generation a short-lived body, or soma, which serves as a vehicle for insuring its transmission and perpetuation."

Another fundamental procedure of growth and development is expressed by the Law of Biogenesis, stating that the individual in its development repeats hastily and incompletely the evolutionary history of its own specie.

For a multicellular organism to develop from a cell, several things are necessary, namely, growth of the individual cell, increase in the intercellular substance, multiplication of this cell into many, and differentiation of some of these cells to form organs and tissues for special functions. As stated before,

full expression of these processes is dependent upon normal metabolic growth forces, functional stimuli, and other extraneous forces. Development molds this growth through resorption and rebuilding until the inherited form for the species has reached maturity.

When one considers the development of the face, bone is the tissue that attracts most of our attention. This is natural because it comprises a great part of the bulk of the face. The bones of the skeleton as a whole have three main functions, namely, support and protection, hemopoiesis, or formation of blood cells, and the maintenance of the mineral balance in the tissue fluids. However, support and protection seem to be the main functions of the bones of the head. Bone is a calcified structure, yet a very plastic substance due to the ease with which bone cells are stimulated to either deposit or absorb bone in line with the amount and direction of stresses applied.

This adaptability of bone, first expressed in Wolff's[6] Law of the Transformation of Bone, states that: "Every change in the form and function of a bone, or of its function alone, is followed by certain definite changes in its internal architecture, and equally definite secondary alterations in its external conformation in accordance with mathematical laws."

Brodie[1] refers to this structural change in this way: "That any bone represents the least amount of material, most efficiently arranged to carry the peak of the load of its function."

Because of this property of bone, orthopedics and orthodontics are possible, and a beautiful example of its application is demonstrated in the long bones of the legs. An individual may increase in weight, and his legs will not warp; instead, they increase in strength, since support of weight is their normal function. The horseman, however, who spends much time in the saddle usually develops bowed legs, warped from an unnatural force which is lateral rather than vertical as nature intended. Alveolar bone responds in the same way, the teeth transmitting the forces of mastication, swallowing, musculature, etc., to the bone. As long as all of these forces are balanced, normal form will be maintained, but if the forces become unbalanced change in form results until another balance is established. This changed form will be abnormal and is termed a malocclusion of the teeth.

There are two general types of bone, compact and cancellous. Each type is distributed in accordance with physiologic and functional demands. The increase in the size of the face is a result of bone growth. Bone grows by an apposition on the bone's free surfaces with corresponding resorptions for the maintenance of balance, and at the sutures. We are indebted to John Hunter[7] for two basic concepts of bone. He demonstrated on madderized animals (1) that bone grew by depositions on its free surfaces and was kept in a state of functional balance by compensating resorption on other surfaces, and (2) that such growth was not equal in amounts in all parts of the bone. Some areas grew more rapidly than others, and this was responsible for changes in proportion during growth.

Bone has the ability to repair itself, a property the teeth do not have, making the services of the dentist necessary. As you can see, nature is a master-workman, and for a dental restoration to be comparable, utmost care

must be taken to restore form, balance, and function of a type required by tooth type.

Alveolar bone, with a special function, is developed coincident to the eruption of the teeth. Growth of this bone is an important factor in facial development and will be emphasized later in this paper.

As the tooth erupts, it undergoes both active and passive changes in position. An active change is the movement of the tooth in respect to its bony crypt, while the relative change in position of the bony crypt due to bone growth is a passive change. The resultant of these changes in position is movement downward, forward, and outward of the maxillary teeth, and an upward, forward, and outward movement of the mandibular teeth. The exact way in which eruption of the teeth takes place is a debatable subject. Some investigators claim there is no active tooth movement, but that eruption is all brought about by bone growth. Others say that the elongation of the roots, forcing against the floor of the bony crypt, causes the tooth to erupt. This fails to explain all of the process, for teeth erupt where no root formation has taken place. Still other investigators suggest that blood pressure is the impelling force in eruption. Probably none of these theories covers the whole process of eruption, but each may be a contributing factor.

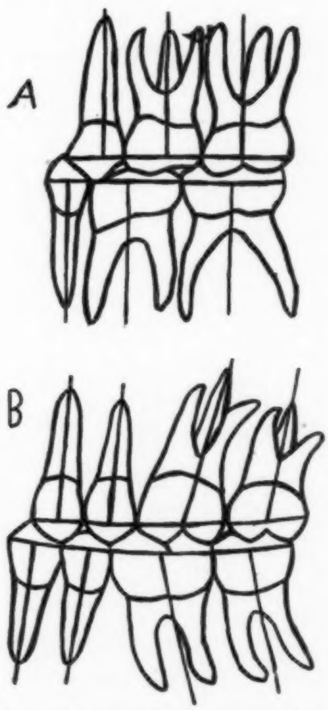

Fig. 1.—*A*, Deciduous dentition showing the crowns setting directly over the long axes of the roots. *B*, Permanent dentition showing the greater bulk of the crowns on the molars mesial to their long axes; and with the distal tip of the roots, developing the anterior component of force when the jaws are closed.

With the eruption of the teeth, the true peridental membrane is formed for their support. It suspends the tooth in the socket, surrounds the root occlusally as far as the tissues are attached, and supports the gingiva. Besides these physical functions it has a vital function, forming bone on the alveolar wall and cementum on the surface of the root; and a sensory function, as the

sensation of touch for the tooth lies exclusively in this membrane. The fibers of the peridental membrane are nonelastic white connective tissue, divided into groups to give the tooth such support as may be needed to counteract the stresses of occlusion. The fibroblasts of the peridental membrane are capable of forming osteoblasts, cementoblasts, and osteoclasts to deposit and absorb either bone or cementum.

When thinking of the head, we must differentiate between the two parts, cranium and face. The cranium serves as a housing for the brain and affords partial protection for other vital organs. At birth the cranium is about eight times the size of the face, which lies under the front part of the cranium. As the braincase is more nearly its adult size at birth than the face, these proportions change with the more rapid growth of the face. The child's head is much more spherical than the adult's, and since the top of the cranium probably does not change much, as it is well sutured with denticulated joints, we must look elsewhere for the reasons of the change in shape. This is found in the increase in length and breadth of the base of the cranium, forcing the lap joints on the sides of the cranium apart. Most of the increase in length takes place at the spheno-occipital suture, that cartilaginous suture that does not calcify until a person is about 25 years of age. Since this suture lies anterior to the vertebral column, the bulk of the cranium is carried forward.

It is particularly significant to note that the spheno-occipital suture does not close until after all teeth are in the denture, but continues to push the midface forward. Otherwise the addition of bone on the tuberosity of the maxilla to make room for the developing teeth would infringe upon the pharyngeal space.

The sphenoid bone, centrally located, through its processes, articulates with all the bones of the cranium and most of the bones of the face. The great wing of this bone, running in three planes, must influence growth of the whole head. Laterally it forces the lower portion of the temporal squama out, widening the base of the skull. Resorption on the inner surface and deposition of bone on the outer surface of the vault also contribute to the widening of the cranium.

The development of the face and especially its forward placement in relation to the cranium result from active growth of the face itself and from being carried forward by growth of the cranial bones with which it is in apposition. The forward push of the cranial bones is on the maxilla only and helps to develop the middle third of the face. The mandible receives none of this help directly, only through normal interdigitation of the cusps on the teeth. If for any reason this normal mesio-distal relation of the maxillary and mandibular teeth slips, and the mandible lags behind, a typical Class II malocclusion develops.

Much of the growth of the maxilla in length takes place along its posterior border to make room for the developing molars. Additional length and most of the increase in width come from the addition of bone on its outer surface, especially the alveolar border, incident to development and eruption of the teeth. Resorption on its medial surface keeps the bone at its normal thickness. Most of the increase in height of the maxilla comes from additions to its alveolar border, stimulated by development and eruption of the teeth.

The growth of the mandible is somewhat similar to the maxilla, but the ultimate is reached in a different way. This bone's only connection with the rest of the head is through a movable joint and articulation of the teeth. It increases in length by surface apposition on the posterior border of the ramus and a cutting back or resorption of its anterior margin. But this inherent growth alone is not sufficient to keep up with the maxilla; so the forward drag on the mandible through the inclined planes of the teeth provides a functional stimulation to a greater increase in length. The increase in width takes place through deposition on the outer surface of the body and ramus of the mandible, and this is compensated for by absorption and modeling on its internal surface. Like the maxilla, alveolar bone gives the mandible most of its increase in height.

From the work of Dr. Broadbent[8] we learn that the temporomandibular joint is relatively stable as to position. Since there are rapid additions of alveolar bone to both maxilla and mandible and a relatively stable joint, some adjustment is necessary to prevent the jaws from being pried apart in the molar region. This is found in the head of the condyle, which exhibits a growth mechanism quite like that of an epiphysis of a long bone, increasing the distance between the joint and the angle of the mandible. In this way the occlusal plane can be maintained, instead of an open-bite.

To summarize growth and development in a general way, I will refer directly to the three growth forces, namely actual, inherent, and functional growth forces. These forces seldom, if ever, permit complete isolation, and must, therefore, be recognized as being of a reciprocatory and interdependent nature. One or another frequently predominates at a particular time. The force produced by the increase in number and size of the cells and the amount of intercellular substance is spoken of as an actual growth force, while the tendency to develop a form characteristic of the species is an inherent growth force.

Much of this paper has emphasized the influences of this force, which is most active from conception to early childhood. With the eruption of the six-year molars and their subsequent occlusion with their antagonists in normal mesiodistal relationship, a functional growth stimulus is developed which gradually replaces the inherent growth force and carries growth and development of the face on to maturity. The more vigorous this function is, the greater the degree of development attained. Class I relationship of the teeth, with the continuity of the arch form unbroken by rotations, extractions, caries, congenitally missing or deformed teeth, and bad habits, contributes the greatest amount of this functional stimulus to forward development of the face.

This stimulus is negligible in the deciduous denture before the eruption of six-year molars. This is undoubtedly explained by the differences in the relation of the crown to the root of the permanent and deciduous molars, since the greater bulk of the crown of a permanent molar is mesial to the long axis of the root, while the crown of a deciduous molar sets directly over the long axis of the root. The resultant of the forces produced by occlusion of the permanent molars is in a forward direction and is called the anterior component of force.

As mentioned before, this is a functional growth force that gradually replaces the inherent growth force and carries development on to maturity. This forward drive of the anterior component of force takes up the wear to maintain contacts, as arch continuity is essential to normal balance between the forces inside and outside the denture.

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FACTORS CONTRIBUTING TO FACIAL GROWTH AND DEVELOPMENT

The Dynamic Factors

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NO PART of the human anatomy arouses so much interest as does the face. The teeth may be considered as the most important organ in the face and probably the reason for the latter's existence. By profession, we are interested in the teeth and face and can make substantial contributions to its development.

Many of the factors enumerated in the preceding paper, such as tooth form, root form, contacts, arch form, etc., are actually static forces in the denture. When they are acted upon by other forces, they became part of a dynamic picture which produces normal occlusion if all are in balance, and malocclusion if this balance is upset.

Since the teeth are immutable once they are formed, adjustments must be made by their supporting structure through attachment of the periodontal membrane. Each tooth, therefore, is a unit of a complex mechanism, and if lost or its correct position disturbed, it paves the way for the other forces to become active with a resulting malocclusion and even a change in facial development.

Since our foundation is bone, it would seem logical to start with a consideration of this important tissue. Bone is not a hard, brittle, unyielding tissue, but rather a plastic material where cells are constantly building and rebuilding according to the direction and intensity of the forces placed upon it. If these forces are normal, bone will be developed along lines it was phylogenetically designed to withstand, but if abnormal, deformity will result.

Forces on the teeth are transmitted to bone only through a pull of the fibers of the periodontal membrane and not by a cushion-like push force which so many believe it to be. Bone is built against this pull force, and this accounts for the heavier plate of bone on the lingual of the upper incisors and for the thin layer of bone on the labial, as mentioned by Dr. Wilkinson. In this area forces are in a labial and mesial direction creating pull forces on the lingual. The form of the roots of the incisors reflects this because of the greater surface area for periodontal membrane attachment on the lingual of these roots. As a result of this arrangement the alveolar process is the recipient of these pull forces, and they in turn are transmitted to the rest of the cranium. Bone is the servant of the teeth, and its form will reflect its function around each individual tooth.

Structurally the alveolar process is indistinguishable from other types of bone, but it shows, as pointed out, a characteristic architecture determined by functional demands. It is formed during and after tooth eruption of both

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deciduous and permanent dentitions and persists only as long as the teeth are present. It attains its greatest development during the permanent dentition. As will be shown later, teeth normally tend to drift mesially. Histologically it can be shown that due to the tension of the periodontal fibers on the distal, bundle bone, which consists primarily of calcified periodontal fibers, is formed, while on the mesial where the membrane is slackened, there will be absorption of alveolar bone. If the intensity of the forces is too great for the supporting tissues, destruction will result instead of construction. This constant adjustment takes place throughout life. For this reason the alveolar process is not static in the support of the teeth, but rather a delicate and sensitive tissue which readily responds to stimuli whether normal or abnormal. It is this characteristic property of bone that makes it such a dynamic factor. Were it not for this, the effect of forces acting on the teeth and supporting structures would be nil.

The deciduous dentition plays a significant role in the development of the face. In addition to its masticatory function it maintains the space for the permanent teeth and stimulates normal growth and development of the jaws. Loss of tooth substance either through decay or extraction almost invariably shortens the arch, and malocclusion results. If we think in terms of the lower arch forming the mold over which the upper fits, we can readily see that if the mold is made smaller, the upper must conform to it. Clinical observation bears out the fact that the lower teeth are the first to erupt. There is no justification for the neglect of deciduous teeth because of their temporary nature. The deciduous teeth are slightly smaller than the permanent teeth except the deciduous molars. Their crowns lie directly over the roots so that stresses are more in line with their long axes. There is little if any curve of Spee.

The period of the mixed dentition is extremely conducive to malocclusion because of the intensity of the growth forces, frequency of disease, and the loss of contact support through the shedding of the deciduous teeth.

The dental arches in man are continuous. There is no diastema between the teeth as found in animals. Because of root form, tooth form, and arrangement of teeth in a continuous arch, the teeth serve as support for one another in the same arch, and they interdigitate in such a way that they also give support to their antagonists in the opposite arch. In other words, all teeth are in apposition with teeth of the same arch and occlude with two teeth of the opposing arch. The only exceptions are the third molars and the mandibular central incisors respectively. All the teeth of the permanent dentition display a slight axial inclination. In the buccal segments this is to the mesial, more prominent in the molars, less so in the premolars. In the anterior segment the mandibular central incisors stand upright, but the remaining incisors also exhibit mesioaxial inclination to a greater or less degree. Because of this design the axes of the maxillary and mandibular teeth cannot be in the same plane; hence forces are not transmitted through their long axes.

During the masticatory stroke, activated by the muscles of mastication as the mandibular incisors pass the maxillary ones, the resultant force is to the mesial and labial on the maxillary teeth and to the distal and lingual on the mandibulars. This force is resisted by the mesial inclination of the teeth on the

opposite side of the midline and by labial musculature. There is a tendency, thus, for the maxillary incisors to move toward the midline, while in the mandibulars there would be a tendency to spread, were it not for the fact that the buccal cusps of the maxillary teeth overlap the mandibulars and make the lower arch the contained arch.

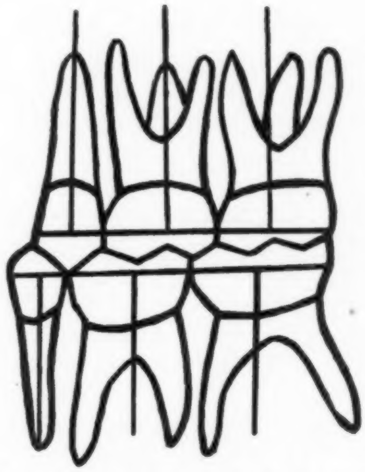

Fig. 1.—Drawing of the mixed dentition. The lines show the occlusal stresses.

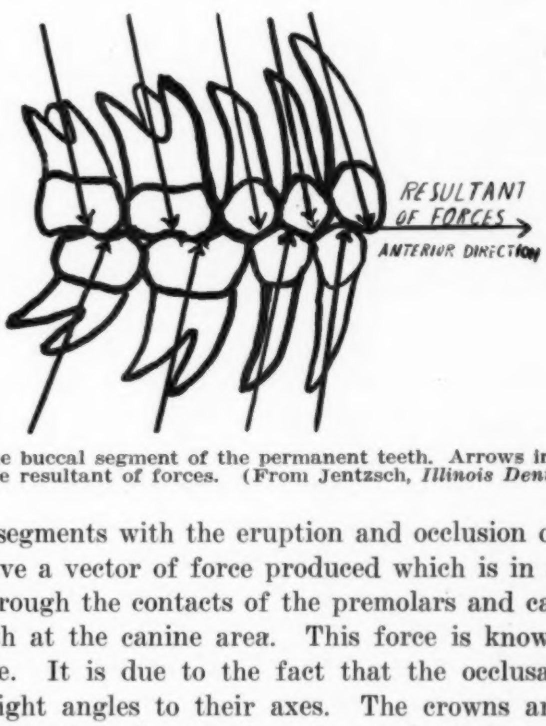

Fig. 2.—Drawing of the buccal segment of the permanent teeth. Arrows indicate the axes of the teeth with the resultant of forces. (From Jentzsch, *Illinois Dental Journal.*)

In the buccal segments with the eruption and occlusion of the first permanent molars, we have a vector of force produced which is in a mesial direction and transmitted through the contacts of the premolars and canine and emanating from the mouth at the canine area. This force is known as the anterior component of force. It is due to the fact that the occlusal planes of these teeth are not at right angles to their axes. The crowns are mesial to their roots, and when the teeth strike together, the resultant of force is in a mesial direction. It is activated by the muscles of mastication during the function of mastication and during deglutition. While mastication is a powerful force, it is used but three times a day. The act of deglutition is performed perhaps three or four times a minute throughout the day, and from a standpoint of developmental stimulation it certainly is the more important of the two. If a

contact point has slipped, or if it has been destroyed by decay or through extraction, there is usually a tendency for a mesial migration of the teeth posterior to the disturbance. Besides contributing to arch form and to the forward growth of the face, the anterior component of force is nature's mechanism for take-up, for wear at the contacts. It is through this force that the contacts become part of the dynamic picture, and when disturbed, changes must take place.

Contacts are those points on the convex approximating surfaces of the teeth where they touch corresponding points on adjacent teeth. It is through contacts that the forces in a mesial and distal direction are transmitted. If the contacts are disturbed, the arch is either shortened or lengthened, and the inclined plane relationship is changed, with a consequent shift in the axial inclination. This will be followed by a corresponding change in the opposing arch.

Since action and reaction are equal and opposite, it must be conceded that the maxilla must resist the blows of the mandible, and yet, from a structural standpoint, they are entirely different. The maxillary portion of the face has

Fig. 3.—Disturbed contacts causing shortening of the arch.

had other functions thrust upon it, such as sight, olfaction, respiration, and air conditioning. These same parts must withstand the mandibular blow. Here again design plays an important part, and we find that the load is carried around delicate parts and transmitted to a broader base, the cranium. This is accomplished principally through the frontal process of the maxilla articulating with the nasal and frontal bones. Laterally is the zygomatic bone, sending one process to the frontal alongside of the eye, another to the temporal, and a third to the maxilla. The latter articulates with the zygomatic process of the maxilla from where it runs downward and outward as the jugal ridge which is almost directly above the maxillary first molar. The pterygoid process through the median of the palatine supports the maxilla from behind. Thus the force of mastication is distributed over a considerable portion of the cranium, and the maxilla withstands only part of the blow.

Since the drive of the anterior component of force is in a forward direction and is a great contributing factor in the development of the face, it would seem that a force so powerful would necessitate some restraint. This is afforded

by the wall of musculature surrounding the denture on the outside, with a musculature organ, the tongue on the inside serving as a form for the dental arch.

The tongue is peculiar in that it has both the power to change its shape and also to change its position. It is suspended from the cranium, the mandible, and through the median of the hyoid bone to the thorax. While it helps to contribute to arch form, the latter also influences the form of the tongue. Normally it nearly fills the mouth, supporting the lingual surfaces of all the mandibular teeth and to a lesser extent the lingual surfaces of the maxillary molars. Forward, however, the maxillary teeth only share the support through the relationship of the inclined planes of the teeth.

Fig. 4.—Side view of the skull showing the frontal process of the maxilla, zygomaticofrontal process of the zygomatic bone and zygomaticotemporal.

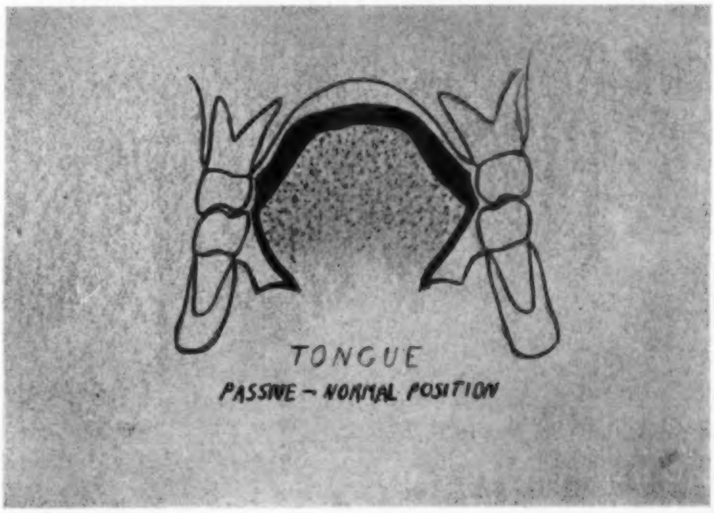

Fig. 5.—The passive tongue position. (From Downs, *Illinois Dental Journal.*)

If the action of the tongue is perverted, it upsets the dynamic equilibrium producing unnatural forces on the teeth and bony structures as well. This is well illustrated in Class III cases where the tongue usually lies in the floor of the mouth or in Class II cases with protruding incisors accompanied by an open-bite.

The band of buccal muscle tissue which helps to keep the arches from spreading will be our next consideration. This force acts chiefly in the upper arch and is transmitted to the lower through the inclined planes of the teeth. Since the tongue is on the inside and the buccal musculature is on the outside, we would be led to believe that these two forces are equal. There is, however, another element which must be considered, and that is the arrangement of the teeth in an arch form. This arch arrangement plus the tongue on the inside produces a balancing effect to buccal musculature.

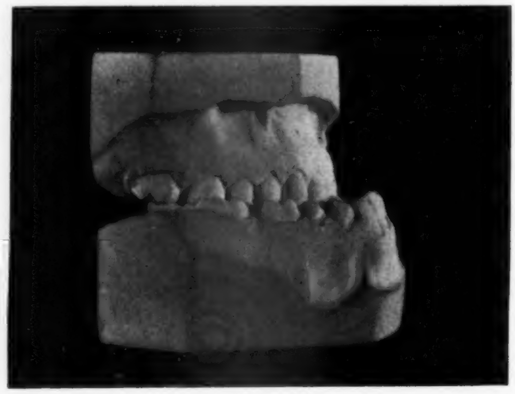

Fig. 6.—Models of a Class III case with the tongue lying in the floor of the mouth.

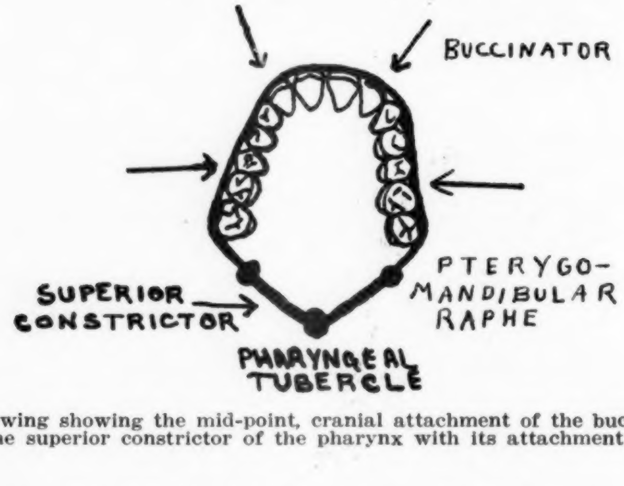

Fig. 7.—Drawing showing the mid-point, cranial attachment of the buccinator muscle and its continuation the superior constrictor of the pharynx with its attachment on the pharyngeal tubercle.

The orbicularis oris consists of the insertions of the various facial muscles and partly of fibers proper to the lips themselves. Of the former the buccinator is the most important. It is the only facial muscle not lying completely within the face. Its bony attachments are the alveolar processes in the molar region of both maxilla and mandible. Anteriorly, it runs forward to be inserted into the orbicularis oris. It is made up of four bands; the superior and inferior pass to the upper and lower lip respectively, while the superior middle band passes to the lower lip, and the inferior to the upper. Posteriorly it swings around the tuberosity, is attached to the anterior surface of the pterygomandibular raphe, is prolonged backward as the superior constrictor of the pharynx, and is attached to the pharyngeal tubercle on the basilar surface of the occipital

bone and to the prevertebral fascia. Thus we have with its fellow from the opposite side a continuous band of muscle with a mid-point cranial attachment surrounding the denture, exerting a lingual restraining force on the teeth. If this were all, such a force would tend toward a semicircular arch without the prominence of the canines, but this is where the other facial muscles exert their effect.

If we consider the masticatory organ as extending from beneath the orbits to the lower border of the mandible, we find that it resembles a truncated pyramid, its surface running outward, backward, and forward. The dental arches, therefore, describe a larger arch than the origins of musculature, with the exception of those which are attached to the zygoma. These muscles, because of their wide origin, act as relief muscles at the canine area, thereby breaking the semicircular arch form and giving the canine the prominence it has. The rest of the musculature of the cheeks and lips runs over a decidedly convex surface before being inserted into the lips, and their forces are lingual and backward.

All of the muscles of the face whose origins are on the maxilla have soft tissue insertions, namely the upper and lower lips. While these muscles contribute to the balance around the dental arches, they do not affect the face as far as the relationship to the cranium is concerned. The maxilla is hafted to the former and is carried forward with it.

Fig. 8.—Front view of the skull. The maxilla resembles a truncated pyramid.

The mandible, on the contrary, is supended to the cranium by the muscles of mastication. The mandible in addition to its function of mastication plays a prominent part in the positioning of the head and in the suspension of the hyoid bone. Arising from the occipital bone and running downward on the back, a powerful group of postcervical muscles tend to tilt the head backward. These must be antagonized, and we find the muscles of mastication whose origin is cranial as the superior group of antagonists to the postcervicals. This is not sufficient, however, so we find another group attached to the lower border of the

mandible which assists in suspending the hyoid bone and the larynx from the cranium. Below this region the infra-hyoid group runs from the hyoid to the thorax. This complex arrangement from the cranium to the thorax keeps the mandible centered and antagonizes the backward tilt of the head. If this dynamic equilibrium is upset, not only is the mandible affected, but also the maxilla as well. This is beautifully illustrated in the mouth breather. As the mouth is kept open, the teeth are out of occlusion, and the tongue travels down with it. The maxillary teeth lose the support of the lower arch, and the buccal musculature is unopposed, driving the upper lateral segments lingually until the mandibulars begin to take some of this tension, and the maxillary teeth have an end-to-end occlusion or an entirely linguoclusion with the mandibular teeth.

With the lower lip fallen away from the maxillary incisors, since it controls their incisal thirds, these teeth are forced labially. Below, the lower lip still supports the incisors, and with the tongue on the lingual the forces are such as to force these teeth to come in contact with the gum tissue of the palate. As the maxillary teeth incline labially, the lower lip gets behind them causing them to move still faster in this direction. This continues until all forces within and without the denture are again in balance. While musculature may be the initial factor in producing malocclusion, its secondary effect is no less important. This was referred to previously under contacts and will be further discussed in the following paper.

Fig. 9.—Models of a Class II, Division 1 case with the mandibular incisors in contact with the gum tissue of the palate.

Another factor upsetting the dynamic equilibrium of the denture is that of habits. Their significance is often overlooked because they operate so quietly and are so unconsciously performed that the patient is unconscious of their existence. They usually involve the musculature around the mouth on the outside and the tongue within, and not infrequently certain forms of external pressures. They operate through localized stresses on the individual teeth or on whole segments of the dental arches. Among the most common are lip-biting, lip-sucking, tongue-thrusting, tongue-biting, lip-wetting, posture habits, thumb-sucking, fingernail-biting, etc.

A definite lingual pressure on the mandibular incisal segment and its alveolar process with a corresponding effect on the maxillary one is produced

by the overactivity of the mentalis muscle. This facial muscle arises from the incisive fossa of the mandible and is inserted in the integument of the skin overlying the chin. This is not a muscle of the lower lip proper, but is tied up with its function and exerts pressure by piling up bulk against the mandibular incisors, forcing them lingually and hollowing out the alveolar process just above the symphysis. As the mandibular teeth are moved lingually, corresponding changes take place in the anterior segment of the upper arch, and we find the maxillary central incisors retruding because of the action of the lower lip on the incisal labial third of the incisors.

Thus, we see that the position of the teeth and dental arches is determined to a great extent by the equilibrium of a myriad of forces acting upon them. As long as these forces remain normal, a normal arrangement of the teeth may be expected. Any unbalance of the forces, however, causes a shifting which will stop only when balance is again restored. This new balance will be in the nature of a deformity.

In closing, let us remember that the denture which we are called upon to guide to its fullest developmental pattern is not a stable or fixed contrivance. As orthodontists, it is our duty to know about its growth and development, to understand the dynamic characteristic of the tissues around it, and to grasp the significance of the forces acting upon it.

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FACTORS CONTRIBUTING TO FACIAL GROWTH AND DEVELOPMENT

Some Practical Applications of These Factors

G. T. Milliette, Milwaukee, Wis.

FROM the preceding papers of this symposium it is evident that when we think of our denture, we mean not only the dental arches, alveolar processes, teeth, peridental membrane, and oral mucosa, but also the muscles of the cheeks, lips, tongue, and pharynx. We learn that we cannot consider the teeth as so many inanimate articles placed in a concrete-like substance bone, but rather one of teeth dynamically suspended in a dynamic substance bone, and their position therein influenced by a dynamic musculature. Truly the denture is a dynamic functioning organ. We also learn that the interplay of the sum total of all these major forces: inherent growth, function, anterior component of force, and the posterior restraining forces of musculature, acting in different manners upon the teeth, results, because of the peculiar property of the bone in which they are placed, in a state of dynamic equilibrium or balance. That is, they reach a state of static equilibrium and movement seems to cease. They are, however, always present as potential forces to start movement should the static equilibrium be disturbed.

This recognition, by Dr. Angle, plus the fact that normal occlusion of the teeth was a basis of normal jaw development at once lifted orthodontics from empericism to the beginning of a science. His further discovery of the manner in which function, through the inclined planes and all the other forces of occlusion, contributed to the harmonious balance and growth of the face aided further.

In the discussion on bone growth by Dr. Wilkinson, he spoke of the inherent growth force of any bone and the effect of functional force. No thoughtful person could doubt for a moment the part that inherent growth plays in bringing any body structure to either a normal or abnormal maturity; but it is equally true that there is not a thinking orthodontist who does not feel that full, vigorous function is also a prime requisite to complete development. However in the final analysis, the extent of the influence of these functional and inherent stimuli depends upon a normal constitutionally healthy individual so that the bone cells may respond physiologically to them.

The general constitutional welfare is a most important factor which may guide the face in its developmental career. This is so well elaborated by the late Dr. Todd and his associates that detail is unnecessary here. One quotation from Dr. Todd will suffice: "In infancy, when the constitution is most susceptible to disturbance, it is the face rather than any other part of the body which registers permanent damage through interruptions of facial growth, a

Read as part of a symposium before the American Association of Orthodontists, Chicago, May, 1940.

damage which shows little tendency to repair and is forever afterwards merely compensated by structural modification."

The constitutional impairment may be, and generally is, reflected in the skeletal development of the child. As a result, not only are growth increments reduced or inhibited, but efforts at restorative treatment may be frustrated. The poorly structured bones of the jaws, already deficient in size, may be unable to retain corrective impulses transmitted to them by orthodontic appliances or by the newly established direction of occlusal forces following treatment.

Still another phase of constitutional inadequacy is to be found in the enlarged adenoid masses and congested turbinates, which may interfere with normal respiration through the nasal passages, but not of themselves disturb the growth pattern. It is only when the impeded passages lead to improper mouth habits that a facial deformity may result. This nasopharyngeal disturbance may also be attributed to an inadequate downward and forward growth of the maxillar to open up the nasopharynx. The work of Dr. Rosenberger has demonstrated the importance of this forward growth in early infancy.

Of these three factors—the inherent growth factor, the functional factor, and the constitutional factor—over which do we as dentists have any control? Certainly we have little or no control over the inherent growth force—yet we cannot and must not minimize its importance. The constitutional factor is a problem chiefly for the medical profession; yet we must consider it important in our diagnosis and prognosis. There remain the functional forces or stimuli, and as dentists we do have, to a great extent, control through the maintenance of proper functional occlusion of the teeth, of these stimuli. These stimuli will be adequate for the full development of the facial bones only when all of the teeth are in proper occlusion; and this is possible only when all of the forces of occlusion are normal. Our part, therefore, lies in keeping those forces of occlusion normal over which we have control through the institution of correct dental operative procedures, and the normalization of these forces through orthodontic procedures when it is necessary.

As this paper calls for a practical application of some of the factors discussed in the preceding papers, and as it is evident that time would not permit but a cursory discussion of all of them, I am going to discuss a local static factor that is disturbed in practically every case we examine—the factor of arch integrity or continuity.

In our studies of comparative dental anatomy we learn that the distinguishing characteristic of our omnivorous type of denture is the lack of any diastema—or spacing of the teeth. We recognize that this, a result of our vegetable diet, results in a mutual support between the teeth. It is of this mutual support which we term arch continuity or integrity that I wish to call attention, with particular reference to the dynamic relation of one arch to the other. I believe that a lack of a thorough appreciation of its significance is responsible for most of our orthodontic failures and misunderstandings.

Dr. Rohde told us that the lower arch, due to the position of the teeth on the alveolar ridge and their time of eruption, may be considered as the mold or foundation upon which the upper arch is to be molded by the buccal mus-

culature. We know that the shape of this arch is influenced by the tongue and tooth form, and that its integrity is secured through the contact points of each tooth. Thus each tooth, through its contact points, becomes an essential key in the dynamic balance of tooth and denture position. We learned that the strength of this arch is increased through its mechanical arch form to resist the lingual displacement forces arising from the masticatory stroke and from the ever-present buccal musculature. It was illustrated that the force of the tongue outward, cannot be considered as equal to the lingual force of the buccal musculature—but rather, that the force of the tongue plus the continuous arch form will be equal to these lingual forces. This buccal musculature has been called the posterior restraining force, as it works against an anterior component of force as illustrated. These opposite forces acting upon the teeth in a mesial and distal direction necessitate a third factor if a balance is to be established between them. This factor is found in the form and position of the teeth, with special reference to the proximal contact points. In newly erupted teeth, and until sufficient wear at the contact points takes place, they are points of apposition on rounded proximal surfaces; therefore, they offer a minimum of stability and are easily displaced.

Proximal contacts have an importance far beyond that which is generally recognized. It is true that proper proximal contacts protect the underlying soft tissues from injury by food impaction, but they also have other functions to perform. Those contacts in the buccal segments may be considered as the transmitters of the anterior component of force in a forward direction. The importance of this force can readily be realized when we consider the fact that the greatest increment of facial development is in this forward direction. The proximal contact points give the tooth, under full function in any one instant, additional support from the adjacent teeth. Any disturbance in these contact points will result in a disturbance in arch continuity. This usually manifests itself by a shortening of the total arch length, with a demand, if this happens in the lower arch, for an adjustment of the upper arch continuity to this new length.

Let us consider some of the local factors that contribute to a disturbance in this arch continuity. Among them we may list the following: the loss of teeth through extraction or by their congenital absence, the rotations of teeth, the loss of tooth structure through decay when it involves the contact points or the improper restoration thereof, the abnormal axial inclination of teeth, excessive occlusal curvatures, the impactions of teeth, excessive occlusal wear of teeth, or a disharmony in the size of the teeth.

In our analysis of the divisions of the denture according to its functional areas we find it to consist of an incisive segment and two buccal segments. In a discussion of the disturbances in arch continuity we find the effect of such disturbances to be the greatest within the segment in which the disturbances take place. For example, disturbances in the continuity of the arch in the incisive segment of the mandible would affect chiefly the intercanine width of that case. With this lessening of intercanine width we would expect one of three methods of adjustment to follow in the maxillary arch. Either a deep overbite would result from this narrowed mandibular arch creeping up within the maxillary arch, or severe rotations of the teeth in the maxillary arch to

adjust themselves to the smaller lower arch width, or as we find in most cases, a resulting combination of these two methods, namely, an excessive overbite with rotations. The particular adjustment found in each case will vary with the type of disturbing factor or factors, with the physiologic age of the patient at the time of its onset, and with the particular inherited tooth form and restraining musculature of the individual.

The loss of a tooth in the buccal segment results in a shortening of the length of that segment by the forces of occlusion already mentioned that are acting upon that area, namely, the anterior component of force and the buccal musculature.* This is best illustrated in the example of the early loss of a mandibular second deciduous molar. Here the six-year molar will tip mesially and to the lingual due to the resultant directions of muscular forces and the normal axial inclination of the teeth released by the loss of the broad flat contact surface of the second deciduous molar. We realize that with this loss of arch continuity we no longer have a transmission of the anterior component of force to the teeth anterior to the space, as a force cannot jump this space. Thus the anterior part of this segment and a portion of the incisive segment are robbed of the functional stimulus and mutual support contributed by the anterior component of force. This results often in a lagging behind or further shortening of these segments. Again this calls for an adjustment of the maxillary arch to this new foundational arch disturbance. Usually the occluding maxillary six-year molar moves bodily forward with the mandibular six-year molar due to the interlocking of the large functioning mesiolingual cusp of the maxillary six-year molar in the occlusal fossa of the mandibular six-year molar. This forces the maxillary deciduous molars and canine tooth forward placing the deciduous canine under the influence of undue muscular pressures at the corner of the mouth. This often results in a premature loss of the deciduous canine tooth, which loss is followed by a closure of that space from forces previously discussed. With the space closed for the permanent maxillary canine it will usually erupt to the labial of the arch.

Perhaps the loss of no tooth in the denture results in a more severe adjustment than does the early loss of the mandibular deciduous canine. A brief thought of its tooth design and location in the arch reflects that it is a part of both the incisive and buccal segments. Its loss therefore must affect both of these segments and call for an adjustment in the mandibular arch at that region. With the integrity of the arch broken there follows a collapse at this site with the lateral and central incisors tending to tip lingually and laterally toward the space. Distal to the space the anterior component of force is unopposed and these teeth will tip mesially while the buccal musculature will tip them lingually until a contact may be established between the lateral incisor and the first deciduous molar; or later between the lateral and first permanent premolar teeth. Following this there is a resulting adjustment in the maxillary arch to this new foundational arch size, the severity of which depends upon factors already mentioned. Usually it manifests itself by locking out the permanent canine tooth in that region of the denture. Often the mandibular

*The particular adjustment varies with the arch disturbed. In the maxillary arch it usually manifests itself by a bodily movement of the molar teeth; whereas in the mandibular arch a tipping of the molar teeth results. This difference is due, perhaps, to the differences in root design of the teeth, as well as the structural differences of their bony supports.

Fig. 1.

Fig. 2.

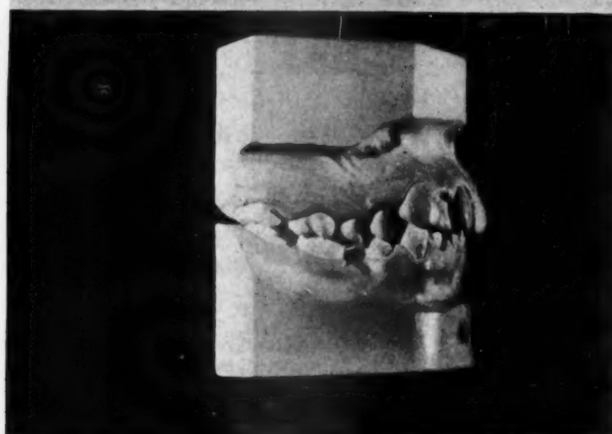


Fig. 3.

Fig. 4.

Fig. 1.—Case of shortening of the arch length in the buccal segments due to an early loss of second deciduous molars and a narrowing in intercanine width, due to the rotations of the incisors.

Fig. 2.—Lateral view of case shown in Fig. 1 illustrating the typical maxillary adjustment to the early loss of the second deciduous molar and rotations.

Fig. 3.—Case of an early loss of the mandibular left deciduous canine tooth resulting in a closure of the space and the adjustment in the maxillary arch.

Fig. 4.—Right and left sides of case in Fig. 3 illustrating the maxillary adjustment.

incisors may creep upward and the maxillary incisors downward seeking an occlusal antagonist until an excessive overbite and rotations may result. This is often the type of adjustment found in those cases where the erupting permanent mandibular lateral incisor tooth will lift out or prematurely absorb the root of the deciduous canine tooth before the permanent canine tooth is ready to erupt. This same result is often observed in the maxillary arch when the erupting maxillary lateral incisor or first premolar will prematurely exfoliate the maxillary deciduous canine during their eruption.

In considering the effects of rotations as factors disturbing arch continuity, we all realize that, when they occur in the incisive segment of the mandibular arch, they represent a lack of lateral growth of that arch and contribute further to a lessening of the intercanine width. Again we must expect adjustments in the maxillary incisive segment to this new arch width. As previously mentioned, the adjustment will usually be one of rotation, or deep overbite, or a combination of these factors. When rotations occur in the buccal segments, they may or may not result in a shortened segment. This will depend upon the tooth design and the particular teeth affected. As a rule, a shortening will result (Fig. 1).

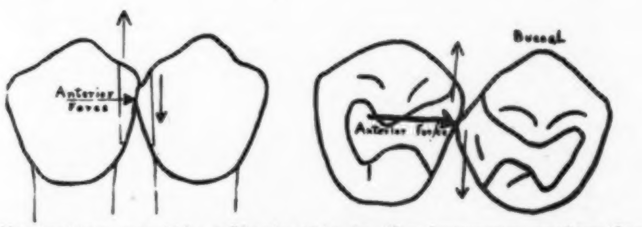


Fig. 5.—Sketches illustrating possible adjustments in the improper restorations of contacts in operative fillings.

Fig. 6.—Case of a disturbance in the axial inclination of the first premolar tooth disturbing its normal contact.

In considering caries and the improper restoration of the contact points through operative dental procedures, it is evident from a dynamic appreciation of the denture that these factors will again contribute to a shortening of the arch form. Where the decay extensively involves the contact point in the buccal segments, we have a shortening of that segment by a tipping of the posterior teeth due to the anterior component of force. Where a contact point is improperly restored in operative dental procedures, an adjustment must take place within that arch and within the occluding arch which usually results in rotations and subsequent shortening of the arch length.

The factor of the proper axial inclination of teeth is very important in the maintenance of a normal arch length. A disturbance in this factor is most common in the buccal segments resulting from a mesial tipping of these teeth. For example, it is often found in Class II cases where the mesial contact point of the first, and often the second, premolar is ducked down below the distal contact point of the teeth mesial to them. This is usualy found where there has been a premature loss of the deciduous teeth in those patients possessing a heavy or well-developed mentalis musculature that increases the conflicting forces at the canine area. Our attention has been called to this fact by Dr. Brodie in his discussion of retention planning for Class II cases where the mesial contact point of the first premolar is below the distal contact point of the canine tooth.

Another factor that is very often overlooked is the shortening effect that an excessive curve of Spee has upon the arch length. This is nearly always found in Class II and in extreme Class III cases and has developed as a result of the supraocclusion of the incisors and canine teeth in these cases as they seek an occlusal relationship. In the Class II cases this occlusion is with the palate and in the Class III it is with the upper lip.

While considering arch curvatures we must not forget an excessive mandibular incisive occlusal curve that is often present in the Class II, Division 1 type of case. Here again this will affect the intercanine width of this arch reducing it in proportion to the degree of curvature.

From a practical standpoint, it is necessary for us to normalize these occlusal curvatures if we expect to restore the mandibular arch to its intended foundational arch length and width. It is evident that an excessive curve of Spee gives added occlusal resistance or drag to the effect of our intermaxillary elastics in the treatment of these cases. With the completion of the Class II case, even though a normal mesiodistal six-year molar relationship has been reestablished, if we permit an excessive curve of Spee to remain, we still have a shortened arch. This shortened arch anteroposteriorly must call for an adjustment of the maxillary arch, which usually results in a deep overbite as the mandibular arch creeps up within the maxillary arch.

Another factor that disturbs arch continuity, particularly in the mandibular incisive region, is that resulting from excessive occlusal wear of these teeth. There may be no rotations of these teeth and arch integrity may appear normal yet due to their crown form and the normal positions of their contact points, excessive wear will result in a narrowed intercanine arch width. This type of disturbance is often found in Class II, Division 2 cases. In planning the retention of these cases this fact must be considered if they are to retain as we wish.

Another factor demanding an adjustment may be expected in those cases where there are congenital absences of the teeth. Again, the particular adjustment will depend upon the segment affected and the particular tooth therein absent.

It is not necessary to discuss the factor of disharmony in size of teeth due either to accidents or inherited or developmental defects. That these do disturb the arch continuity is evident to all.

Fig. 7.


Fig. 8.

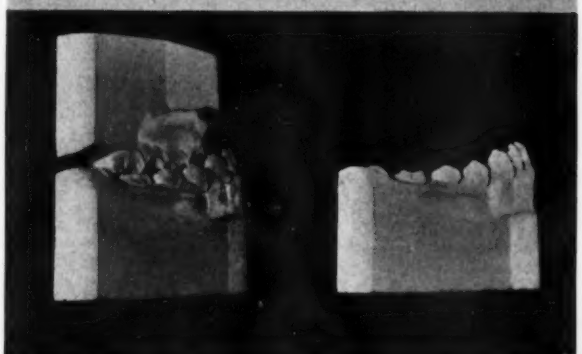

Fig. 9.


Fig. 10.


Fig. 7.—Case illustrating the improper axial inclination of both premolars and canine teeth.
Fig. 8.—Class II case showing an excessive occlusal curve of Spee.
Fig. 9.—Class III case of an excessive occlusal curve of Spee.
Fig. 10.—Case illustrating an excessive incisive occlusal curve.

Since the re-establishment of normal arch integrity within the individual arches is, therefore, a major problem to the orthodontist, and since this means the normalization of all contact points through the correction of all rotations and axial inclinations, it is evident that in the plan of our appliance we design it, or use one already designed, for this purpose.

Considering orthodontics only from its mechanical aspect, we realize that this normalization of arch integrity within the individual arches, plus the normalization of their mesiodistal relationship to each other and cranium, and the normalizing of the dynamic forces acting upon this denture, constitutes our problem.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 11.—Class II, Division 2 case illustrating excessive occlusal wear of the mandibular incisor.

Fig. 12.—Class I case showing excessive occlusal wear of the mandibular incisor.

Fig. 13.—Case illustrating the adjustment of the arches to a congenital absence of a mandibular incisor.

Let us learn to appreciate the fundamental factors concerning our denture dynamic. Let us learn to consider the mandibular arch as the contained foundational arch for the maxillary denture with an appreciation of the mutual support of the teeth, and realize that if we neglect to restore all of them to their normal position, we must expect some adjustment or relapse in the case.

FOR REFERENCES SEE PRECEDING PAPERS.

A SNAP-CHANNEL, TIE-LOCK ATTACHMENT

ANDREW F. JACKSON, D.D.S., PHILADELPHIA, PA.

A LARGE number of tooth attachments have as their basic principle the conversion of an open slot or groove into a lock, once the wire for its accommodation has been placed therein. Many of these require intricate manufacturing procedures impossible in the ordinary office. Most of them are also designed specifically for certain gauges and types of wire.

It is desirable, therefore, to be able to make, with little difficulty in the office, an attachment which will meet these requirements, adaptable to several gauges of wire and of various sizes to meet the individual requirement of specific cases.

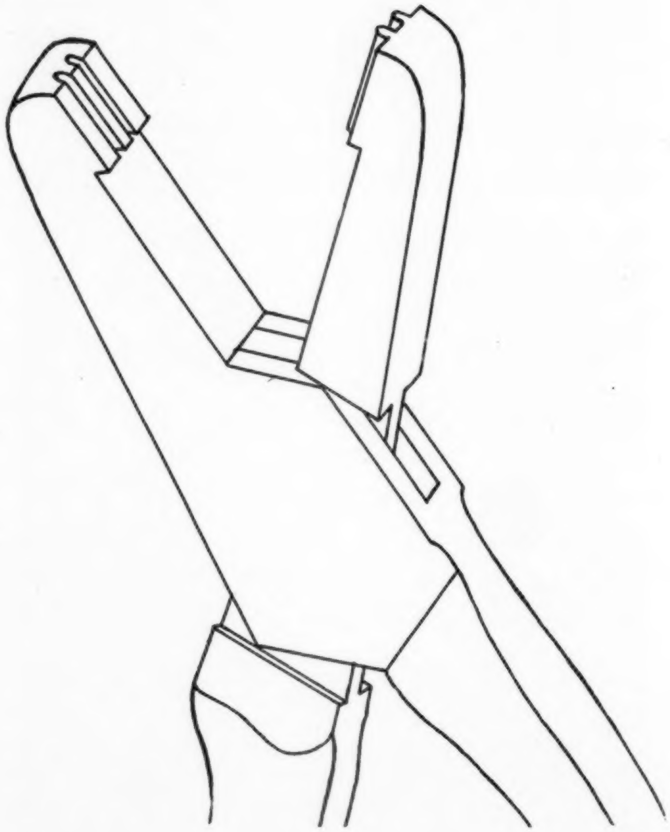


Fig. 1.

After considerable experimentation, I have found that the attachment which I shall here describe fulfills these requirements.

The only special instrument that is required is a pair of pliers which have been cut with two grooves to accommodate two flanges, as illustrated in Fig. 1.

Presented as a clinic before the American Association of Orthodontists in Chicago, May, 1940, and the Southern Society of Orthodontists in New Orleans.

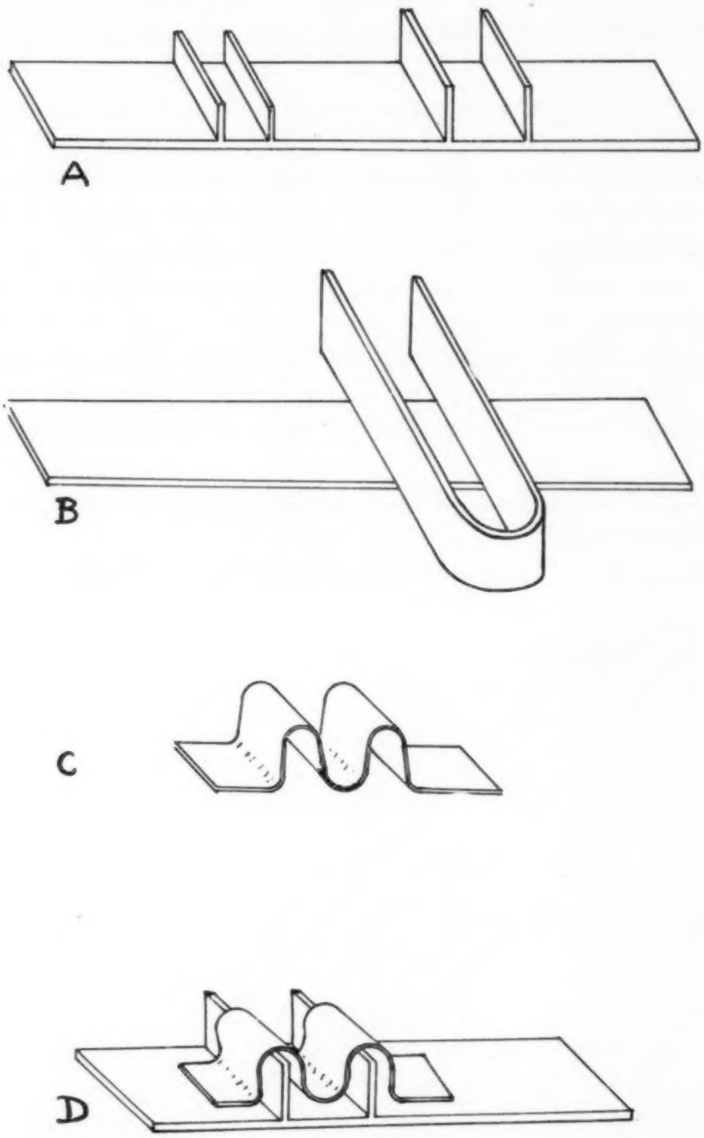


Fig. 2.

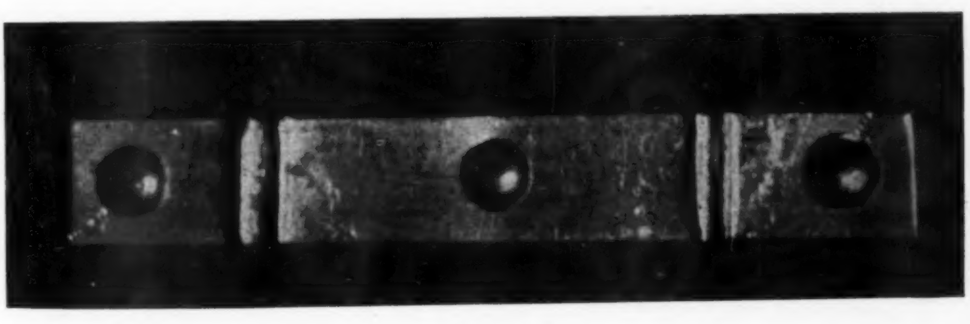


Fig. 3.

A piece of band material 0.006 inch in thickness is placed between the beaks and one quick pinch produces a corrugated piece of metal as illustrated in Fig. 2 *C*.

A second piece of permanent equipment is made in the office in the following manner: A length of 0.006 platinized gold band material is cut and upon it are soldered several pairs of upright sections of 0.006 band material, spaced variously to accommodate the thicknesses of the desired gauges of wire, and also cut to the various desired heights (Fig. 2 *A*).

An easy way to solder these uprights is to cut a narrow length of 0.006 band material, bend it over on itself so as to leave a space of the desired width between the sides, lay it crosswise on the 0.006 band material, and solder it in this position (Fig. 2 *B*). After this is done, the surplus is cut off and the uprights are trimmed to the desired heights. In this way any number of variations can be made.

A convenient way to handle these devices, after they are made, is to tack them to a piece of board, as illustrated in Fig. 3.

The gauges I have found most desirable are 0.020 or 0.022, 0.030, and 0.038.

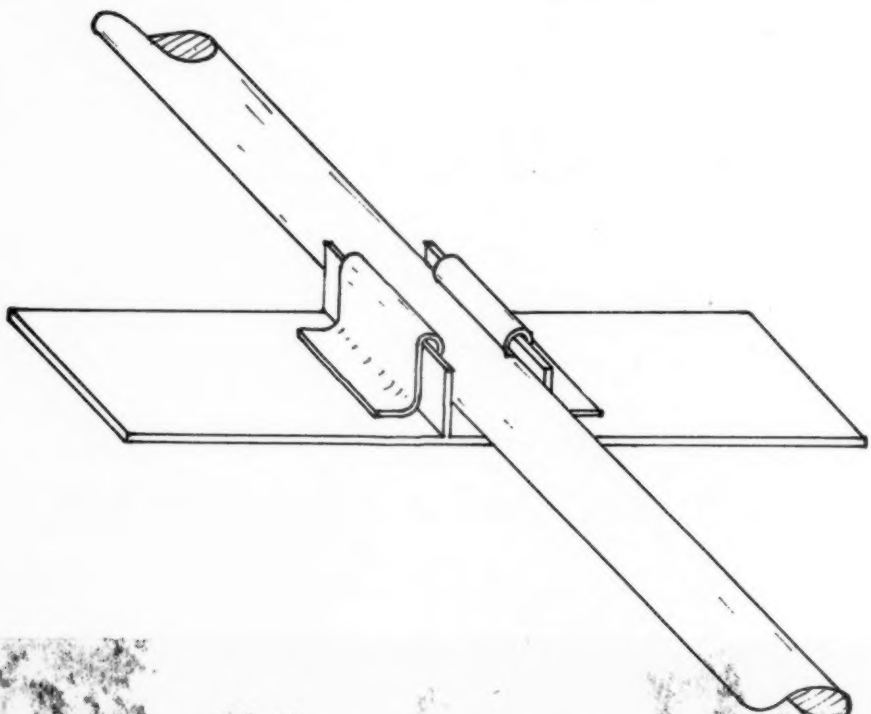


Fig. 4.

The piece of corrugated 0.006, shown in Fig. 2 *C*, is then placed over two of the uprights as illustrated in Fig. 2 *D*. If a channel to accommodate 0.020 wire is desired, the corrugated piece is placed over the uprights which were designed for this gauge.

A section of 0.020 wire is then pressed firmly over the corrugated piece between the uprights, and while it is being held firmly there, the two side extensions are squeezed against the sides of the uprights with a pair of Angle band-

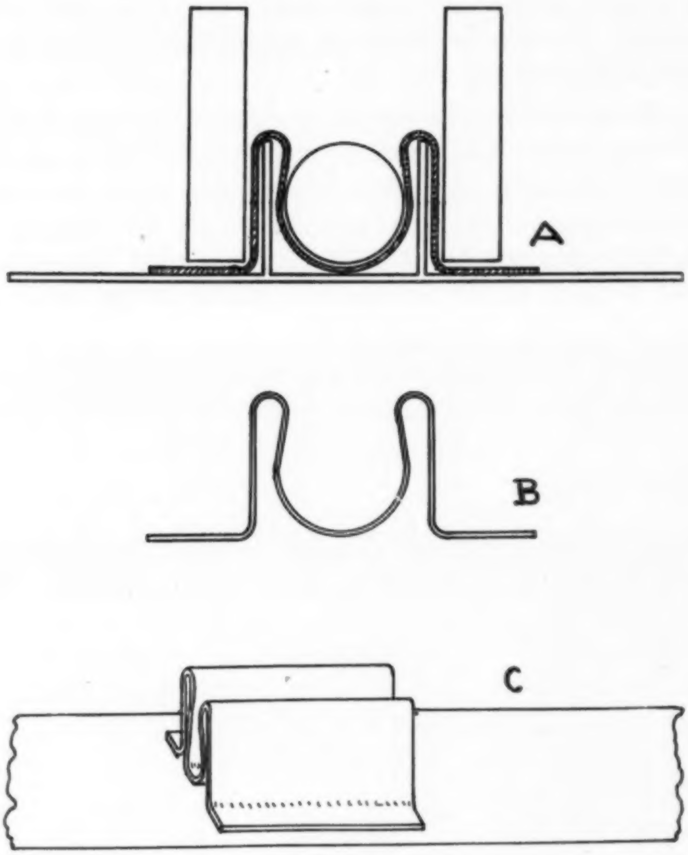


Fig. 5.

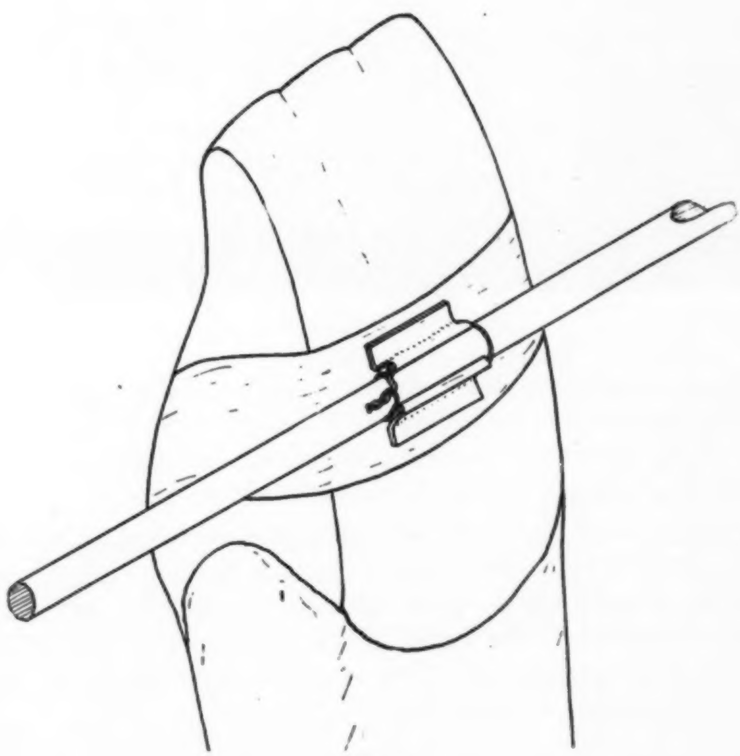


Fig. 6.

forming pliers, as illustrated in Figs. 4 and 5 *A*. The result will be a snap-channel into which the wire for which it was designed will secure itself quite firmly and which will look like Fig. 5 *B*.

This attachment is then soldered on a length of 0.003 band material for use on a tooth. I have found that Jelenko's "plastic solder" of gold solder filings mixed with flux is especially suited for this purpose, as it is necessary to have a firm even attachment of all the parts in contact. By first heating the band material slightly, the solder and flux will spread evenly over the area to be soldered; the attachment is then placed in position, and a brush flame does the rest (Fig. 5 *C*).

If extra security or stability is required in addition to that furnished by the elasticity of the snap, the arch wire may also be tied in place by passing a strand of thin stainless steel ligature wire through the loops and over the arch, twisting the ends securely (Fig. 6).

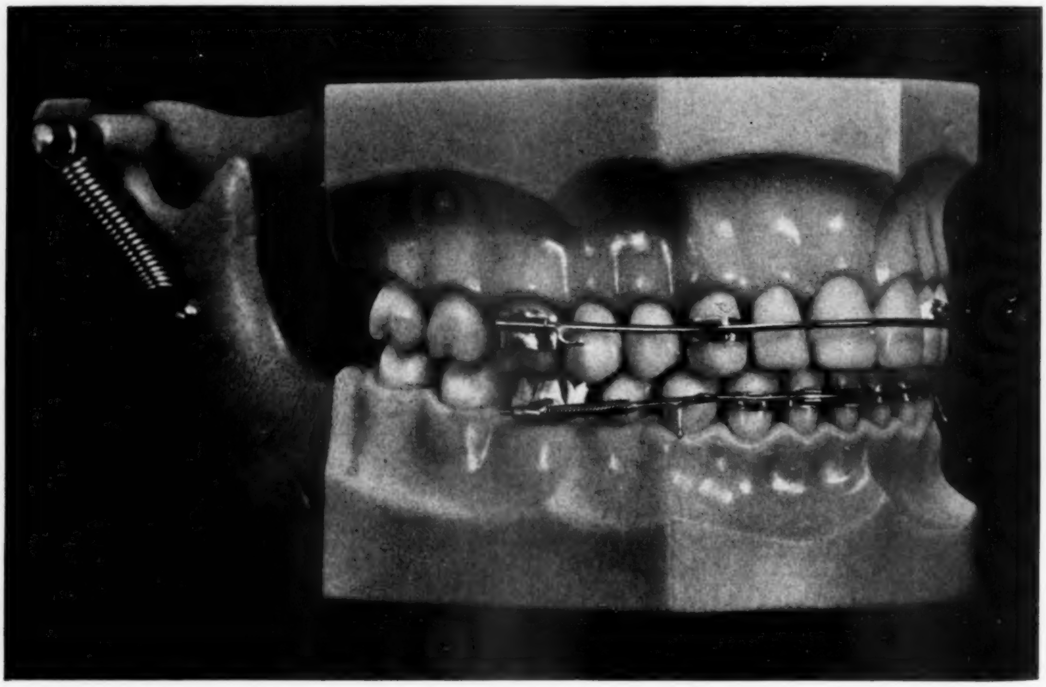


Fig. 7.

The method of tying is also desirable when the displacement of a tooth is such that it is not desirable to lock the arch completely in position at any given adjustment. This permits of several gradual adjustments, without distorting the arch wire or producing too much pressure on the tooth.

Figs. 7 and 8 show the technical application of this lock to various uses. On the lower arch the six anterior teeth have been banded with channel brackets attached for the accommodation of an 0.022 arch wire. The anterior section of arch has been soldered to 0.038 ends. Spiral springs have been attached to create more space anteroposteriorly. This is an excellent procedure for this purpose when there is danger of open-bite.

The bracket on the upper right canine, Fig. 7, has been made to accommodate the main labial arch of 0.038 gauge.

The bracket on the upper right lateral, Fig. 8, has been made to accommodate the free end of a labial auxiliary spring of 0.020 gauge. By means of this spring, a variety of individual movements can be produced simultaneously on this tooth. It may be rotated in either direction, the root may be inclined mesially or distally, and the tooth itself may be moved labially, lingually, mesially, or distally. The principle of this technique is applicable to an infinite variety of individual cases.

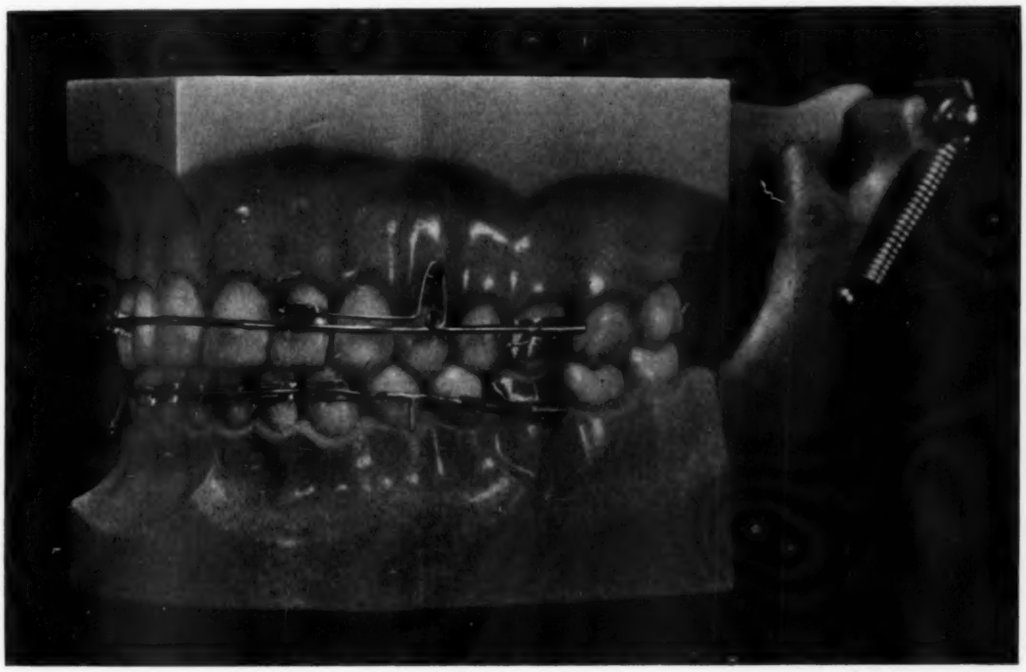


Fig. 8.

These snap-channel brackets can be made without the use of the corrugating pliers, with greater ease in making the larger sizes 0.038 or 0.040 than the smaller. The pliers which have been described were made especially for use in constructing the 0.020 and 0.022 sizes. They are not entirely satisfactory for the larger sizes, and it is therefore desirable to use other pliers which will make deeper corrugations for these sizes in order to produce the best results, with the least amount of effort.

BIOMETRIC NORM VALUES AS THE BASIS FOR THE CHOICE OF OUR APPLIANCES OR METHODS OF TREATMENT

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THE determination of the norm plays a decisive role in modern medicine. The knowledge of the norm is not only an important presupposition to every diagnosis, and consequently also of every therapeutic measure, but it is also indispensable for eugenics. Only with a clear understanding of the norm of the organism may we solve the now so closely considered questions of the prevention of diseased conditions and constitutions.

As is well known since Quetelet's fundamental researches, the scientific definition of the normal is achieved with the aid of the so-called biometric norm. Such a norm means the average value of findings obtained by means of numerous single measurements. Of course, it is not only this single middle value which is regarded as normal. Can each value found on healthy persons be considered as normal? Neither is acceptable. There exists today a mathematical convention for this norm which is expressed with the aid of dissemination. Those values which are within $M \pm 2\,\sigma$ (M=middle value) are regarded as normal, yet we must remember that the limit values are situated within the sphere of anomalies. Each statement in medical manuals on size, shape, weight, etc., of organs is nothing but a biometric norm. How indispensable such norms are for modern therapeutics may be seen in the important role of the norm weight of the thymus gland. How often were sudden deaths in forensic medicine cleared up by the evidence of a doubled, persistent thymus gland of 50 to 60 grams.

In orthodontics it is only since the publication of P. W. Simon's research work that the biometric norm is taken into consideration. Yet it cannot be denied that a large part of the orthodontists are bitterly fighting against the application of biometric norm. They consider biometrics a superfluous luxury of figures, and they are not inclined to acknowledge them either as a basis for diagnosis or as a guide for therapeutic procedures.

This opinion is not only completely false, but it also degrades dental orthopedy itself. Instead of stating long theoretical considerations I might point out practically the importance of some biometric norms. In my opinion they play an important role, not only in respect to diagnosis, but also as a basis for the choice of our appliances. It is not wise to stick to a stereotyped treatment or method in each case. It is regrettable that this idea, an inheritance of the first and purely mechanical period of orthodontics, returns incessantly. It seems as though orthodontists cannot free themselves from the thought of mechanical therapeutics. The more biologic orthodontics is spoken of, the more decisive the construction and the manner of application of a certain apparatus seem to become. This method is completely wrong, even if such opinion were supported by a most skillful propaganda and by great tenacity, or

by pointing to various proofs and most surprising results. How often have we heard that this or the other appliance or method meant a turning-point in orthodontic therapeutics? I admit that a uniform method of treatment appears very enticing, but from a medical standpoint such an effort is simply ludicrous. Would not a surgeon be ridiculed if he claimed a cure for every stomach-ache, without any distinction, by means of a uniform method, for instance, by appendectomy? Yet this is done by those orthodontists who propagate one method or the other, or declare one device or the other as a turning-point in orthodontics. A real turn would come if all orthodontists became aware, at last, that orthodontics is an integral part of medicine. It is only medical thinking which can lead us to our aim. But medical thinking includes, in the case of each anomaly, the following considerations:

1. How to recognize deviations from the biometric norm (diagnosis).
2. Which factors were the causes of the given deviations from the morphologic and physiologic norm (etiology).
3. Which ways are at our disposal to turn back aberrant development into its normal direction, and by which means and how far may we repair such pathologic changes as took place (therapeutics).

It follows from all this that the question of the method of treatment depends upon each case. I am of the opinion that by overestimating and overappreciating the question of mechanisms, the aim cannot be reached at all. We shall do only harm, in that respect, for by one method or the other many colleagues might be induced to indiscriminate treatment. The bad results, which follow inevitably, will prejudice not only each colleague separately but also above all the whole profession.

The practical application of some biometric norms in orthodontics is presented. Out of the great number of practically applicable norms I choose the Pont index on one hand, the orbital-canine rule (P. W. Simon) and the normprofile diagrams (Malán-Rehák) on the other. The first gives us invaluable aid for the transversal, the latter ones for sagittal anomalies.

PRACTICAL APPLICATION OF THE PONT INDEX

The Pont index is known to represent a correlative index between the width of the teeth and that of the jaws. It helps in determining the degree of the contractions or distractions, and it has proved very useful in practice. From it we may determine immediately in a given case, by means of the width of the maxillary incisors, the respective jaw width. We get a numerical idea about what the normal width of the jaw should be. Thus the required value represents the biometric norm. The degree of contraction is then determined on the basis of the Pont index; it may be small (about 2 to 3 mm.), medium (about 4 to 7 mm.), or large (more than 8 mm.).

The Pont index alone is not sufficient for the diagnosis of the contractions. As mentioned before, it serves only in the determination of the degree of the contraction. With each contraction, of any degree, we must moreover consider some other points of view. The lateral comparison to the median plane gives us the symmetric conditions. The localization of the anomaly is first made in a horizontal direction: anterior or posterior; if both total contractions, then in a

vertical direction: dental, alveolar or maxillary, respectively mandibular contraction.

Such a diagnosis of the contractions, based on the principles laid down by P. W. Simon, actually gives an exact status praesens. This, however, contains some important factors concerning the etiology of the case. For example, a small dental contraction will point rather to some local cause, than a strong maxillary contraction, which may involve pathologic processes in the jaw or in the whole organism. Clear information thereon we naturally obtain only by a detailed history which we must not neglect in any case.

Only now follows the question of the therapeutics of the given case. This must rather be influenced by our diagnostic and etiologic findings, than by the praise of some apparatus.

PRACTICAL APPLICATION OF THE ORBITAL-CANINE RULE

The orbital-canine rule is known to give the relation of the jaw to the orbital plane. According to P. W. Simon this relation remains constant during the growth of the skull. It is determined by circumstance that normally the orbital plane cuts the point of the maxillary canine teeth, and on the photostat profile it runs through the cheilion and gnathion. From the prosthion the orbital plane is at a distance of 5 mm. in the projection.

The observation of this biometric norm gives us the key to the diagnosis and therapeutics of sagittal anomalies. Of course—as is justly emphasized by Baume in a recently published work—we must not make this norm the aim of therapeutics. It informs us only of the direction, degree, size, relation, etc., of normal development, yet it is left to our judgment whether, in a given case, we try to attain this norm or may only approach it. It was this that Franzmeyer expressed when he wrote that we must not stick servilely to the orbital-canine rule.

It is especially in cases of extraversion of the canine teeth that the orbital-canine rule plays an important role, as it makes possible an exact differential diagnosis of these cases. The extraversion of the canine tooth may be caused by posterior lateral protraction and then, in certain cases, premolar extraction is advisable. But if, on the other hand, the canine extraversion is caused by incisal retraction; then, of course, the premolar extraction is not permitted.

PRACTICAL APPLICATION OF THE NORM-PROFILE DIAGRAMS

The norm-profile diagrams are known to give us nearer information on the profile of the facial skeleton. In order to determine the normal definitive face profile and also to clear up normal harmonic face proportions, we laid down statistically, on a group of skulls, some projective measures, starting from the porion, to correlative points on the facial skeleton itself (nasion, nasospinale, prosthion, dentale superius, infradentale, gnathion). Thus we obtained so-called male and female norm-profile diagrams. The mean values are given in Table I.

These two norm-profile diagrams may be considered as a sufficiently certain basis for the judgment of the face profile of the mixed and crossed population of a Central European city. By means of these diagrams we can determine at

TABLE I

CASE MEASURE	EMBRYONAL LIFE MONTHS					POSTEMBRYONAL LIFE MONTHS			POSTEMBRYONAL LIFE YEARS				MALE M	FEMALE M
	5	6	7	8	9	6	12	24	6	9	10	12		
Porion-Nasion	30	35	38	43	49	60	62	75	74	82	82	87	95	90
Porion-Subnasion	32	36	40	43	48	59	62	77	76	82	86	90	97	92
Porion-Prosthion	32	37	40	46	47	57	63	76	78	83	91	92	102	98
Porion-Dentale Superius									79		94	95	107	103
Porion-Infradentale						56	63	73	80	82	94	96	108	104
Porion-Gnathion	33	37	41	47	52	66	68	83	98	90	100	108	120	115
Number of	108	108	108	2448	2451	108	2458	8881	2685	2376	2386	8867		
skull	1	2	5			10								

once, in a given case, from a teleradiogram the divergencies in the development tendency of the single measures, and thus draw conclusions on the face profile. We are able especially to determine for the sagittal anomaly (Angle Class II and III) the part of the teeth, of the alveolar process, of the apical basis and the jaw bones, etc., in the origin of the anomaly.

The question arises, to what extent these findings, determined on matured individuals, are to be applied to children. In order to clear up this question I took the same projective measures on some "normal" embryonal, infantile, and puerile skulls of the collection of the Anthropological Institute of the Royal Peter Pázmány University (Budapest). The results of these measurements demonstrate that not only from the sixth to twelfth years on, but even with the embryo and the newborn infant, there exists the same tendency of development as with matured individuals. Especially a distinct, though not quite so expressed, difference of size between the porion-nasion and porion-gnathion projections is manifest, although the mandible has not yet been exposed to any functional irritation (sucking, chewing, etc.). In the 12-year-old child there is nearly the same relation of the measurements as in the adult.

These norm-profile diagrams are of particular importance, because, since the introduction of teleradiography, it is easy to determine on the teleradiogram the same cephalometric projections on any living person. Besides, the comparison of tracings, made in different periods, renders it possible to follow the development and growth of the respective case.

The above statements can best be proved by a description of some cases.

CASE 1.—Gy. É. was a girl, aged 9 years.

Diagnosis.—There were small (3 mm., after Pont) symmetric dental contraction, maxillary incisal dental retraction and asymmetric (left) posterior protraction, maxillary incisal dental abstraction, mandibular incisal dental attraction. (Clinically: deep-bite, Fig. 1).

History.—There were no data on the heredity of the anomaly. In infancy and early childhood she had had weak bone development (rickets?). At that time vitamin and calcium treatment were administered according to the patient's physician. She had an asthenic type of constitution.

Therapeutics.—In my experience, small contractions may very well be influenced by removable appliances. Therefore, in this case we put on a rubber plate provided with a Badcock screw. The deviations of the maxillary incisors and the left posterior protraction were removed by corresponding springs vulcanized into the plate. The child wore such plates every night for four years. We sometimes had to prepare new plates according to the changes of the deciduous teeth and of the progress in extension. We endeavored to increase the mechanical growth stimulus accomplished by the plate by administering repeated doses of calcium and vitamin. We also succeeded in eliminating the protraction and the deep-bite, and in correcting the position of the maxillary incisors (Fig. 2). Only the maxillary left protraction has not completely disappeared as yet. This is distinctly shown by the left distoclusion (Fig. 2). In my opinion we can content ourselves with this result, as it was proved by Hellman that "normal occlusion," as found in the manuals, may be found only in every fifth man.

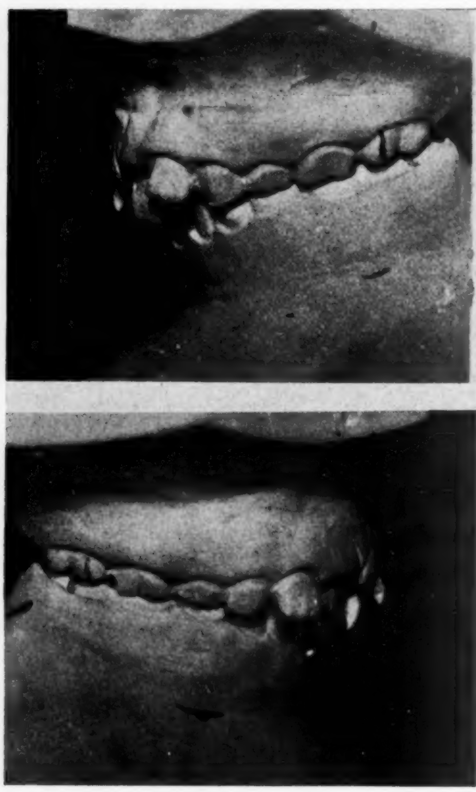

Fig. 1.

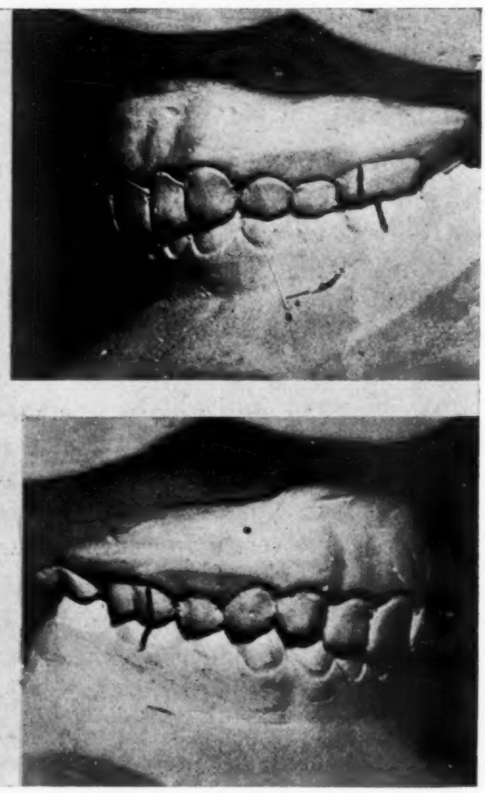

Fig. 2.

Fig. 1, Case 1.—Gnathostat model from the side before treatment.
Fig. 2, Case 1.—Gnathostat model from the side after treatment.

The composite tracing of the teleradiograms before and after treatment (Fig. 3), made for comparison, shows instructively the effect of our plates and the growth changes as well. The increase of the Bolton triangle points to a growth in the brain skull. The alteration of the facial skull and that of the profile has been much more considerable. Both the maxilla and mandible show a growth forward, downward, and backward. Most probably it is due to the

bite elevation by our plates that the occlusion plane has been tipped forward, and the nasal floor and the occlusal plane show a stronger convergence after the treatment than before, and that the facial index, which had shown an euryprosopic value before the treatment, became mesoprosopic after it. The head index was brachycephalic and remained unaltered.

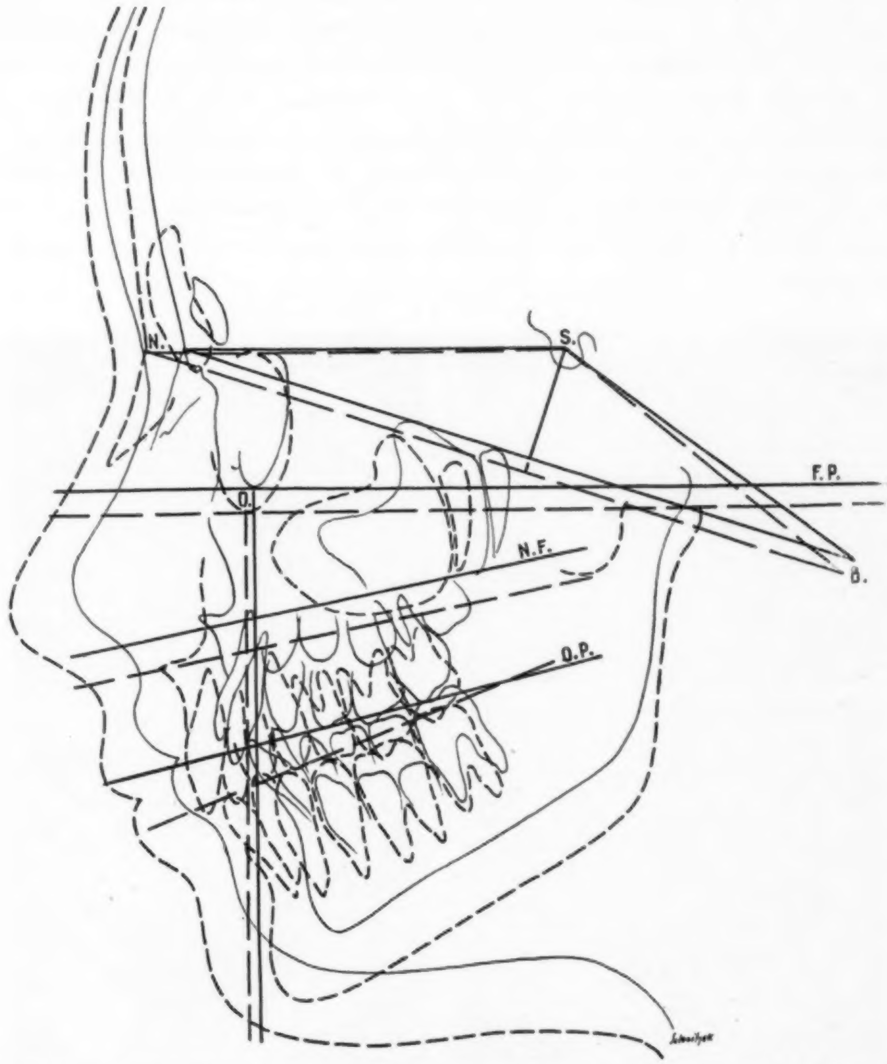

Fig. 3, Case 1.—Teleradiogram composite tracing before and after treatment. *NSB*, Bolton triangle. *F.P.*, Frankfort horizontal. *N.F.*, Nasal floor. *O.P.* Occlusal plane.

Case 2.—V. S. was a girl, aged 8 years.

Diagnosis.—There were medium (6 mm., after Pont) symmetrical alveolar contraction, different malpositions of the maxillary and mandibular incisors, deep-bite, right inverse incisor overbite (Fig. 4).

History.—The dental anomaly was hereditary. She had been a well-developed, fat child from birth. Her nutrition was one-sided for she liked only fat food (bread and butter, salami, etc.). Her physician found disturbed stomach evacuation. The child was put on a diet, mainly fat decreasing, and

told to take more milk and milky dishes (calcium), besides fruits and vegetables (vitamins). She was of the pyknic type of constitution.

Therapeutics.—Considering the medium contraction which moreover was likely hereditary, we decided not to experiment with removable appliances. We had learned that medium contractions can be eliminated much more surely by fixed appliances. Besides, I have been of the opinion that a removable mechanism is always but an experiment, as we are too much dependent on the patient's cooperation. The appliance was a plied arch (Faltbogen), after P. W. Simon, in the maxilla and a lingual arch after Mershon in the mandible. The divergencies of the single teeth were eliminated by corresponding springs. We may count, of course, on a shorter duration of treatment when using fixed appliances. The results of one and a half years' treatment are shown in Fig. 5. The still remaining distal and deep-bite have been removed by means of a Hawley plate.

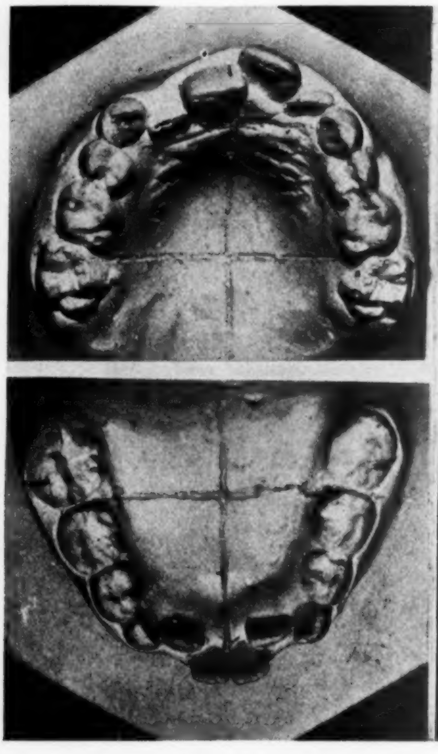

Fig. 4.

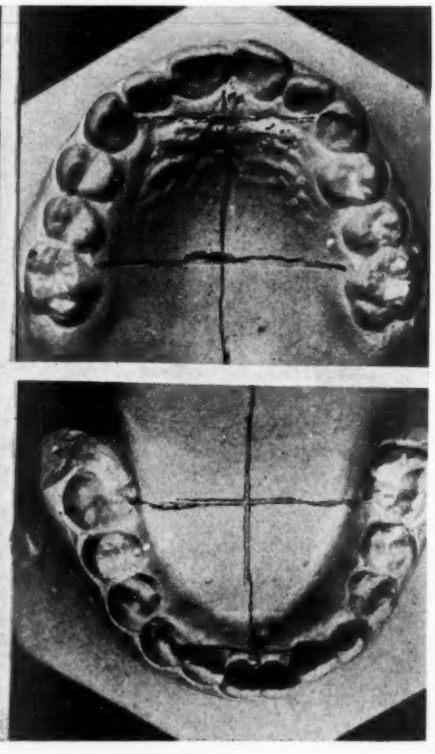

Fig. 5.

Fig. 4, Case 2.—Gnathostat model from above before treatment.
Fig. 5, Case 2.—Gnathostat model from above after treatment.

The composite tracing of the teleradiograms, made before and after treatment for the purpose of comparison, shows a growth both of the brain skull and the facial skull. The latter developed mainly forward and downward. It is conspicuous that there is almost no growth backward. The nasal floor and the occlusal plane show a stronger deviation after the treatment than before it (Fig. 6). The facial index, euryprosopic at the beginning, became mesoprosopic at the end of treatment. The brachycephalic head index remained unaltered.

CASE 3.—D. Z., a girl, was 15 years old.

Diagnosis.—Strong (16 mm., after Pont) symmetric maxillary and mandibular contractions were present. Because of these, naturally numerous malpositions took place in the single teeth, above all the extraversion of the maxillary canine teeth, and torsions of the maxillary and mandibular incisors (Fig. 7).

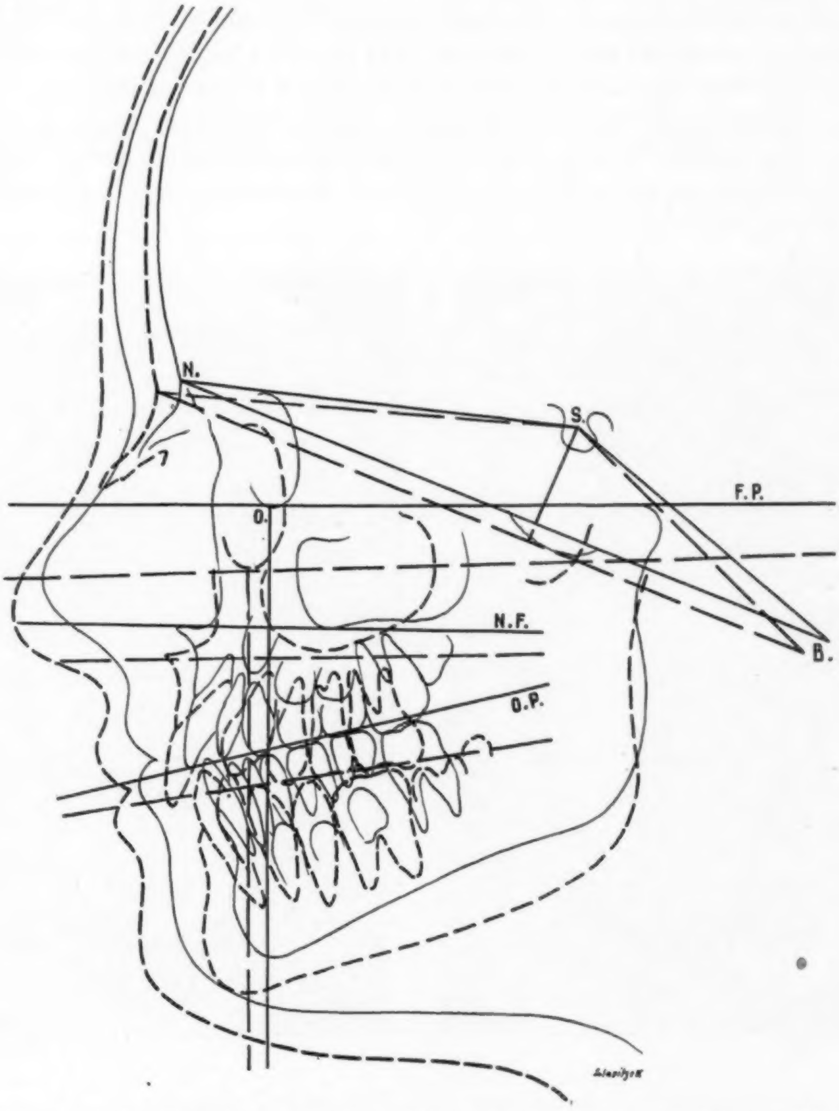

Fig. 6, Case 2.—Teleradiogram composite tracing before and after treatment. *NSB*, Bolton triangle. *F.P.*, Frankfort horizontal. *N.F.*, Nasal floor. *O.P.*, Occlusal plane.

History.—The dental anomaly was hereditary, both on paternal and maternal sides. A younger sister had an Angle Class II, Division 1 malocclusion. The patient had always been a well-developed child and showed no sign of rickets or any other bone disturbance. Adenoids had been removed in the sixth year of age. She had an athletic type of constitution.

Therapeutics.—The only cause of the extremely strong contraction and of the resulting deviations of the single teeth seemed to be a hereditary one. Such

a disharmony between the width of the teeth and that of the jaw cannot be eliminated by any of the orthodontic appliances; nor is it possible to attain the biometric norm of the jaw, as the girl is already 15 years old. According to anthropologic measurement a bone growth of only about 5 per cent can take place after the age of 15 years. Because the jaw was only 40 mm. wide in the molar region, an extension of 2 mm. was all that could have followed as a result of natural growth. We had to attain a growth of 16 mm., i.e., a transversal growth of 40 per cent. This we were not able to perform by any of our appliances or treating methods, as it was a *biologic impossibility*. On the basis of these considerations we had to decide to sacrifice some teeth in order to equalize, to a certain extent, the strong disharmony. Therefore we extracted the four first premolars and created a more satisfactory relation between the teeth and the jaw.

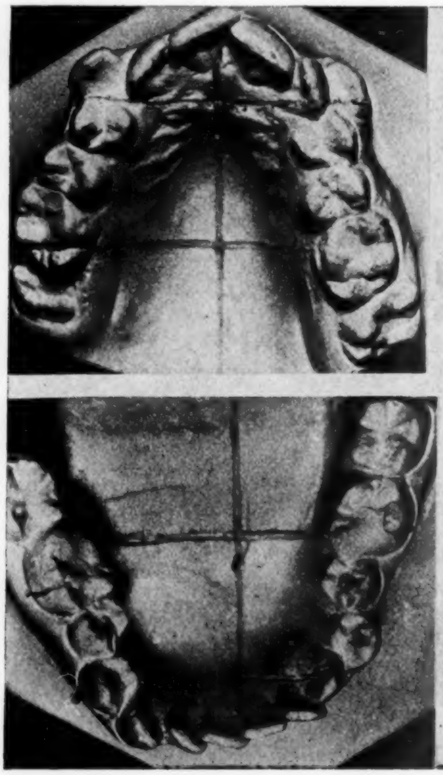

Fig. 7.

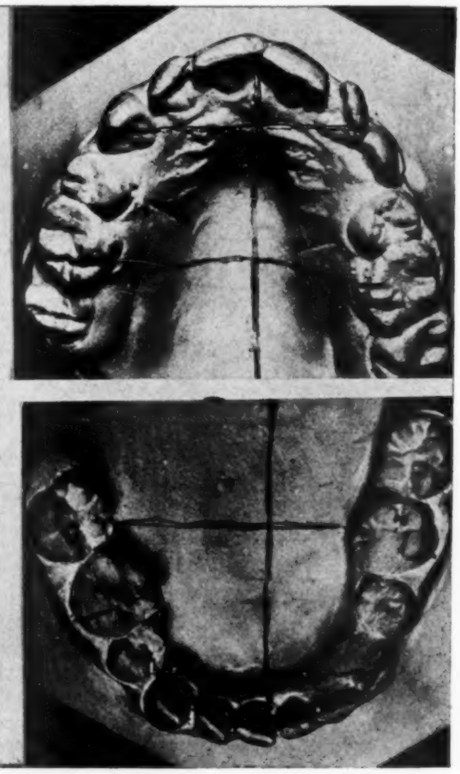

Fig. 8.

Fig. 7, Case 3.—Gnathostat model from above before treatment.
Fig. 8, Case 3.—Gnathostat model from above after treatment.

After the extraction of the four premolars, the canine teeth were moved bodily into the gaps of the premolars. This took place after one year of treatment, as shown in Fig. 8. At present this case is in the stage of a medium contraction. The incisor divergencies may easily be eliminated by means of corresponding appliances.

The composite tracing of the teleradiograms (Fig. 9), made for comparative purposes, shows almost no change of the brain skull and the facial skull. The hyperleptoprosopic facial index and the brachycephalic head index, both

of which remained unaltered, prove that the effects of our treatment confined themselves to the strictly taken denture. The projective measures were taken from the corresponding teleradiograms. Compared with the values of a norm-profile diagram these figures show an inverse relation of the porion-nasion projection to the rest of the facial projections. From this it follows that besides the transverse anomaly (contraction), there was also a sagittal anomaly, i.e., a retarded growth of the face profile.

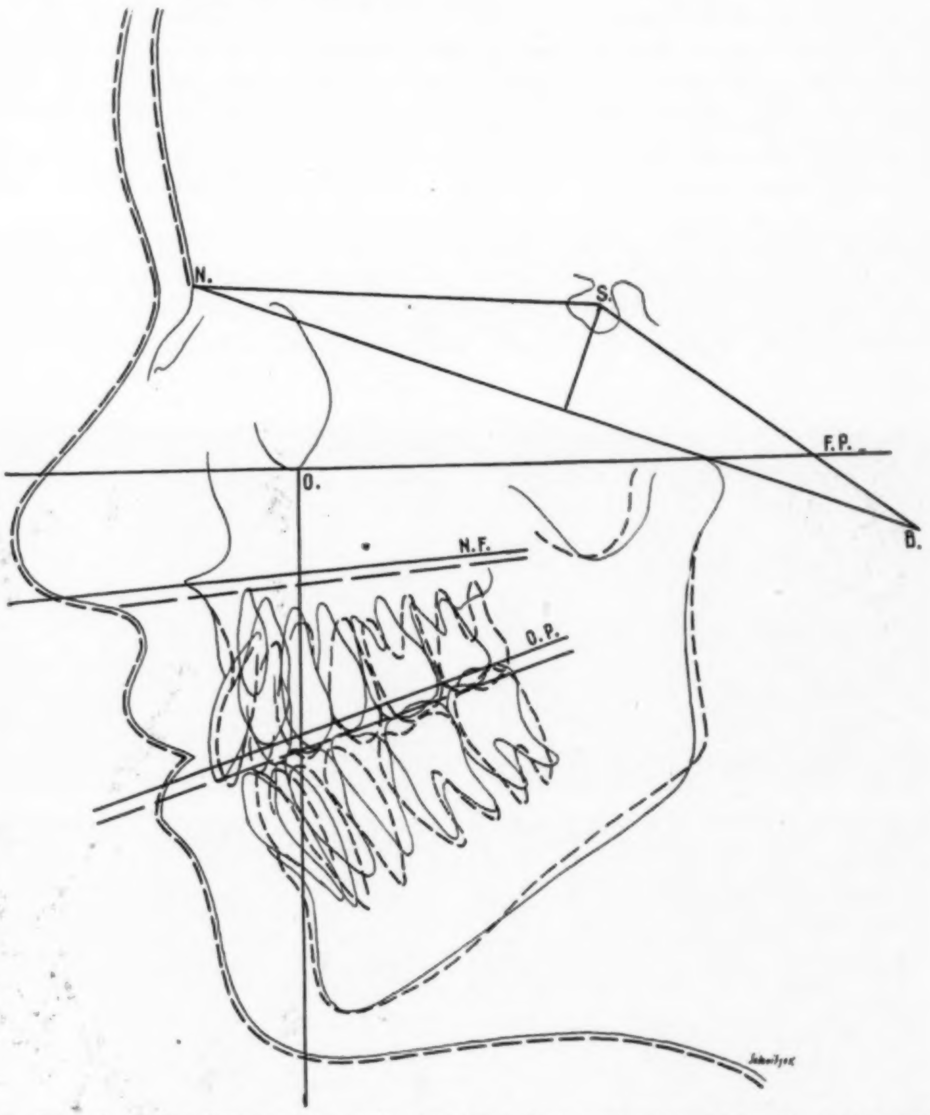

Fig. 9, Case 3.—Teleradiogram composite tracing before and after treatment. *NSB,* Bolton triangle. *F.P.,* Frankfort horizontal. *N.F.,* Nasal floor. *O.P.,* Occlusal plane.

The two next cases of canine extraversion serve as examples for the practical application of the orbital-canine rule, as mentioned in the introduction.

Case 4.—A. B. was a boy aged 14 years.

Diagnosis.—There were small contraction (3 mm., after Pont) posterior lateral protraction on both sides in both jaws, deep-bite, caused by maxillary incisal attraction.

TABLE II

THE VALUES OF THE PROJECTIVE MEASURES OF THE BEGINNING AND END OF THE THREE DESCRIBED CASES

CASE MEASURE	FIRST CASE, GIRL, AGED 13 YEARS BEGINNING	END	SECOND CASE, GIRL, AGED 8 YEARS BEGINNING	END OF TREATMENT	THIRD CASE, GIRL, AGED 15 YEARS BEGINNING	END	FEMALE M
Porion-Nasion	86	96	81	86	90	90	90
Porion-Subnas.	83	92	78	80	85	85	92
Porion-Prosthion	85	94	83	88	88	88	98
Porion-Dentale Superius	87	95	87	86	93	93	103
Porion-Infradentale	86	92	87	86	95	95	104
Porion-Gnathion	92	104	98	100	108	109	115

History.—The dental anomaly was hereditary. There was normal development of the deciduous teeth, with early extractions, because of strong caries of some of them. Perhaps these contributed to the forward movement of the back teeth. Otherwise, he was a well-developed child, with an athletic type of constitution.

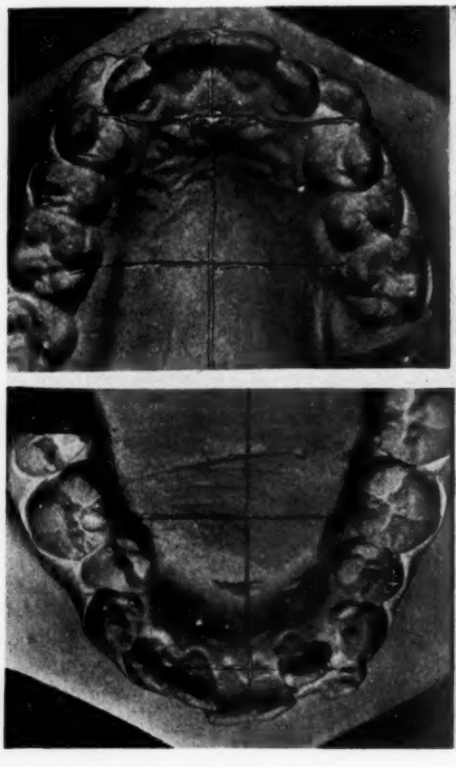

Fig. 10.

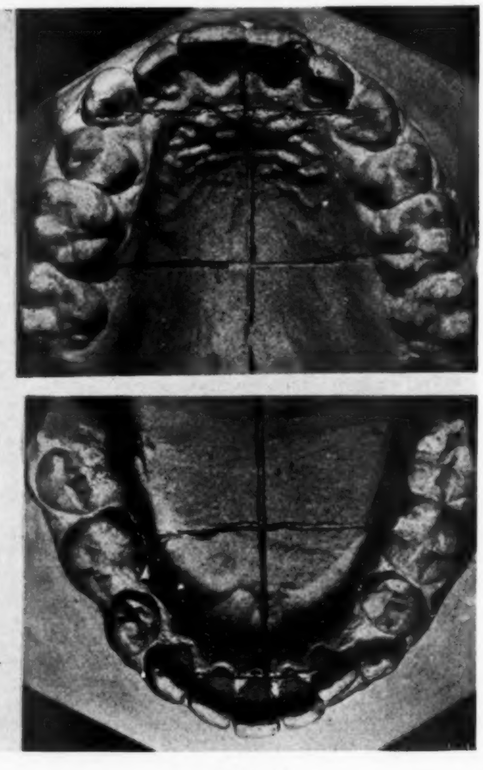

Fig. 11.

Fig. 10, Case 4.—Gnathostat model from above before treatment.
Fig. 11, Case 4.—Gnathostat model from above after treatment.

Therapeutics.—The ideal treatment would be the distal shifting of all molars and premolars, in order to gain place for the canine teeth. Yet this way of treatment seemed hopeless, as the twelfth year molars were already broken

through or in the stage of cutting. Therefore, in this case the extraction of premolars was advisable. We extracted four premolars: $\frac{4\,|\,4}{5\,|\,4}$. After the removal of the premolars, the canine teeth were again brought bodily into the gaps. Thereby we succeeded in obtaining the results shown in Fig. 11. This case demonstrates how we arrived at the indication for the premolar extraction by means of the orbital-canine rule.

CASE 5.—H. É., a girl, was aged 11 years.

Diagnosis.—There was strong contraction in both jaws (10 mm., after Pont), also incisal, dental, and alveolar retraction. Maxillary incisal dental abstraction and mandibular incisal dental attraction (clinically: deep-bite) were noted and numerous deviations of the incisors, besides canine extraversion (Figs. 12, 13, and 14).

History.—The dental anomaly was hereditary. As an infant and small child she had exudative diathesis and poor development. She had an asthenic type of constitution, a remarkably small body, with the mammae strongly developed for her age and different other corporal and psychic signs of prematurity.

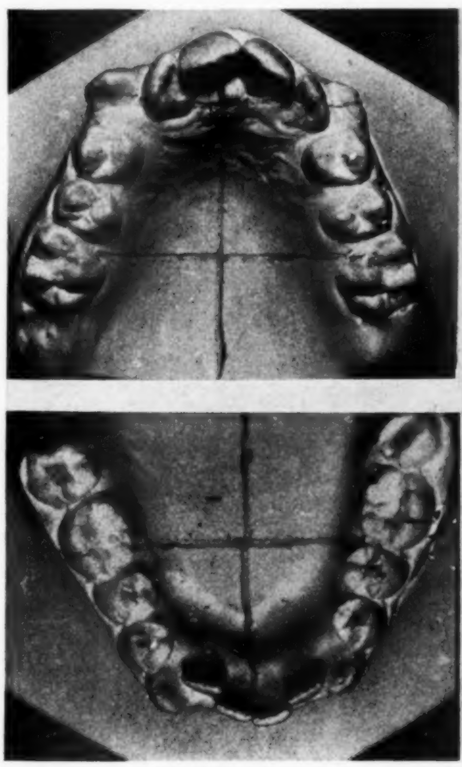

Fig. 12.

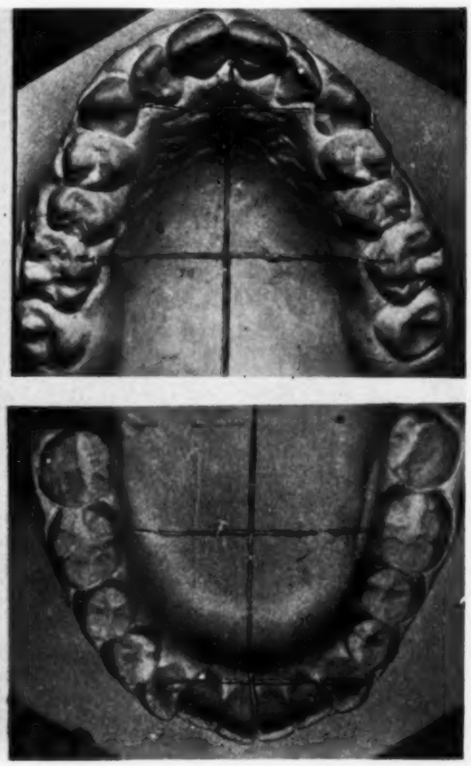

Fig. 13.

Fig. 12, Case 5.—Gnathostat model from above before treatment.
Fig. 13, Case 5.—Gnathostat model from above after treatment.

The girl was treated with gland preparations, consisting of Auxanin B tablets and Praeloban injections. Auxanin B tablets contain hypophysis pars anterior, thymus and pineal gland extracts. Praeloban is a medicament contain-

ing hypophysis pars anterior. In my opinion the strong growth of the bones that followed this treatment made it possible for us to extend and stretch the dental arches sufficiently by means of our mechanical orthopedic appliances.

Therapeutics.—The foundation for the corresponding jaw orthopedic treatment is furnished by the orbital-canine rule. Because the canine extraversion was caused by incisal retraction, extraction was prohibited in this case. We have to make space by expanding and stretching the dental arches. As a matter of course, we never can produce a sufficiently strong alteration of the jaw with mechanical means only, but the combination of the jaw orthopedic methods (above plied arch, Faltbogen, below lingual arch, with an endocrine cure, Auxanin B and Praeloban) has led to a very fine result, as shown in Figs. 13, 14, and 15. The jaw bones and the whole body of the child have grown considerably; the height increased from 138 cm. to 156 cm. within three years.

As a matter of course, the endocrine disturbance is not always so remarkable as in this case. We have found such forces interfere with most dental and jaw anomalies; especially at dentitio tarda we must always think of endocrine growth retardation. In such cases I have several times observed good results with Vaduril; although this is not a specific organ preparation, its promoting effect on jaw growth is beyond doubt. It decidedly is a valuable support to our mechanical orthodontic therapeutics.

Fig. 14. Fig. 15.

Fig. 14, Case 5.—Photostat profile before treatment.
Fig. 15, Case 5.—Photostat profile after treatment.

The composite tracing of the teleradiograms taken before and after treatment (Fig. 16), made for comparative purposes, most clearly demonstrates the strong growth of the brain skull and facial skull. The nasal floor and the occlusal plane show a stronger divergency after the treatment than before. The facial index changed during the treatment from mesoprosopic to leptoprosopic, i.e., the face became longer.

Table III shows the values of the profile diagrams before and after treatment, compared with the female middle values. The increase in the projective

measure distinctly proves the strong growth of the skull. Particularly striking is the increase of the measures in the dental region which is undoubtedly the effect of our orthodontic mechanisms. Although the measures obtained at the end of the treatment do not completely correspond with "normal" values, yet the present esthetic impression of the face is much more favorable than it was before the treatment. If we observe the two profiles closely (Figs. 14 and 15), it is remarkable that the one taken before the treatment presents a much older impression than the other taken after the treatment. This is likely to occur in connection with the endocrine disturbance.

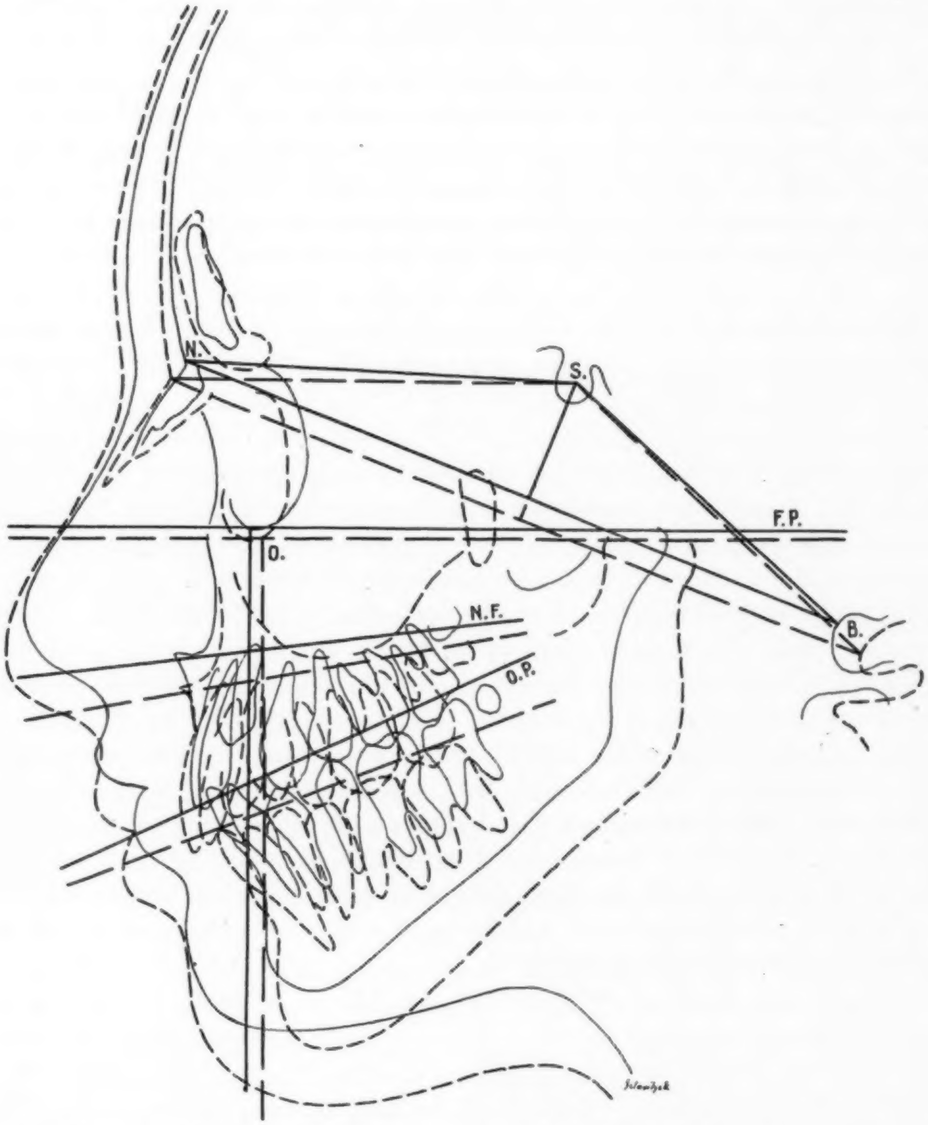

Fig. 16, Case 5.—Teleradiogram composite tracing before and after treatment.

These discussions and cases distinctly show that the biometric norm values do not represent a superfluous luxury of figures, as alleged by some orthodontists. On the contrary, they are of great importance. It is they that give us information about the size, direction, and degree of "normal" development.

TABLE III

THE PROJECTIVE MEASURES OF THE FIFTH CASE AT THE BEGINNING AND END OF THE TREATMENT

MEASURE	FIFTH CASE GIRL, AGED 11 YEARS BEGINNING OF TREATMENT	END OF TREATMENT	FEMALE M
Porion-Nasion	85	90	90
Porion-Subnasale	83	87	92
Porion-Prosthion	84	92	98
Porion-Dentale Superius	89	98	103
Porion-Intradent.	88	94	104
Porion-Gnathion	95	105	115

They show us—as justly emphasized by P. W. Simon—the divergence from the aim of treatment. But only in possession of the knowledge of the divergence from our purpose, and of the causes which determine it, are we able to design a right plan for the treatment. In my opinion, this is the only way to choose the right appliances and the right method of treatment of a given case. The choice of the right appliance saves much time and anxiety and leads more surely to success.

Therefore, instead of stereotyped proceedings, let us rather deliberate after medical points of view, and let us act accordingly.

SUMMARY

The author defines his attitude toward the common tendency of overrating the question of methods of treatment and mechanisms. Instead of the so-called and seemingly uniform methods, we should direct ourselves toward the diagnostic and etiologic findings. By the example of three cases with contractions, the author points out the correct choice of appliances. Small contractions are best treated by removable plates, middle ones by fixed appliances, but strong ones only by means of extractions. By two cases with canine extraversion the author demonstrates the practical application of the orbital-canine rule. In a case with lateral protraction some premolars were removed in order to bring the canine teeth into the range. In the case of incisal retraction, where the profile diagram also showed a strong sagittal retardation of growth caused by endocrine disturbance, which was treated with glandular preparations, the desired space for the canine teeth has been gained by expanding and stretching of the dental arches. But the leading motive is to act after medical points of view, and not after stereotyped methods.

THE STATUS OF ORTHODONTICS IN LATIN AMERICA

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IT IS a well-known fact that the progress of orthodontics is intimately bound up with the development of odontology, for orthodontics constitutes the highest expression of dentistry, inasmuch as it contains the highest scientific refinements, both in the field of biology and in that of mechanical dentistry.

The history of the development of orthodontics has shown that in different periods different countries attached importance to the development and progress of this branch of odontology. The men engaged in the practice of the former were always, fortunately, important members of the dental profession.

At present orthodontics has reached its highest development in the United States, and there it continues to flourish. This is probably due to the high degree of civilization and economic well-being enjoyed by that country.

On the other hand, a paragraph taken from a friendly and sincere letter addressed to me by Dr. Toriello of the city of Guatemala points out the reason why orthodontics has not achieved its due development in most of the Latin-American countries: "No one of us," says Dr. Toriello, "specializes exclusively in the practice of orthodontics, due to the fact that we have a population of only 160,000 inhabitants of which 100,000 are poor people who look after their teeth only in cases of unbearable pain."

There are governments whose mission in such cases would be to bear the expenditures relative to public health and to establish or develop orthodontics as public health services. However, their financial situation does not permit the establishment of such beneficent, popular services; and, on the other hand, they are engaged in the solution of their greatest problems, such as the fight waged against the high percentage of illiteracy, the efforts for the incorporation of the Indian into the prevailing civilization, and for the upliftment of the Indian's standard of living (a work which in recent years the Government of Mexico has been carrying on with favorable results).

Nevertheless, it is only fair to point out that the public is at least demanding the correction of dental anomalies. In large centers of population there has been a considerable increase in the number of orthodontists, and many are engaged exclusively as practitioners of orthodontics with real success.

Let us briefly analyze the present situation of orthodontics in Latin America.

This paper contains, unfortunately, deficiencies due to the lack of literature and of sufficient data, indispensable to an adequate study of the subject. Publications on orthodontics are both rare and isolated. The leading articles on orthodontics are published in the well-presented Argentine review *Ortodoncia*, the pride not only of our colleagues in the Argentine but also of all Spanish speaking orthodontists.

Read before the Fourth Annual Orthodontic Conference of the College of Dentistry, University of Southern California. Los Angeles, Calif., Aug. 8, 1940.

It is with satisfaction that we can state that in Latin America, Argentina occupies first place in the ascending development of orthodontics. In Buenos Aires there is a group of men of science and research in the field of orthodontics, headed by the learned teacher, Dr. Juan Ubaldo Carrea, who is intelligently seconded by indefatigable and dynamic Dr. Armando E. Monti, as well as by Drs. Dueñas, Guardo Jr., Finocchietti, Otaño Antier, Sammartino, Locci, and many others.

Not only is importance attached in the Argentine to the practice of orthodontics, and to research in the field, but also to the teaching of the science. Three universities provide courses in orthodontics. Of these the most important is at Buenos Aires, where the course in orthodontics constitutes a department of the Dental School, within the School of Medical Sciences. The other two are the universities at El Rosario and Córdoba.

The course of orthodontics is ably given by the distinguished professor, Dr. Carrea, assisted by professor Dr. Monti. In a paper on the orientation and program of study courses of the University of Buenos Aires, presented by Dr. A. Cabanne at the IX International Congress held in Vienna, we are informed with reference to the teaching of orthodontics as follows: "The only new subject is that of orthodontics in charge of professor Dr. Juan U. Carrea. This course includes the teaching and practice of orthodontics without any pretense to turn out full-fledged orthodontists in one year, but men equipped, however, with a solid foundation to achieve the goal, as is demonstrated by the able orthodontists which this training has produced."

As a testimony of the splendid work done at the University of Buenos Aires, Dr. Augusto Taiman, Professor of Orthodontics at the Universidad de San Marcos, Lima, Perú, stated in the *Bulletin of the School of Odontology,* in an article reviewing the history of the teaching of orthodontics in the Argentine: "About the year 1920 the teaching of orthodontia as a branch of odontology was started in the Department of Odontology in the School of Medical Sciences of the University of Buenos Aires. The head of the Department, Dr. Carrea, has been teaching the course and sharing his vast experience with distinguished pupils who now constitute a nucleus of professionals of established reputation who do honor to American orthodontics." The scientific works, all of real value, published by Dr. Carrea from the year 1918 to date, are so numerous that only to name them would require considerable time.

A distinguished pupil of Dr. Carrea is Dr. Monti, president of the Sociedad Argentina de Ortodoncia and editor of *Ortodoncia,* the official organ of the society, since April, 1937, published in Spanish. Dr. Monti published in 1938 a complete work on orthodontic appliances, *Aparatología Ortodóncica,* which presents with liberal treatment almost all the fixed and removable appliances known. It is a work having a distinct didactic value worthy of a university trained exponent. Its pages contain excellent illustrations which make it a work of truly great scientific merit and of practical usefulness to professionals as well as to students, particularly Spanish speaking students.

Mention must be made even briefly of the Instituto Municipal de Ortodoncia y Odontología Infantil (Municipal Institute of Orthodontics and Odontology

for Children) of Buenos Aires, a model institution, perhaps the only one of its kind in America. Founded in 1934 and supported by municipal funds, the Institute operates six clinics, each in its respective district and each equipped with ten dental chairs. These six clinics give dental service to approximately 200,000 children annually. It is in this institution that orthodontics ceased to be a treatment reserved exclusively for the well-to-do classes, for there the children of the poorest families receive the same excellent service. Furthermore, it is a center for postgraduate work and study where true specialists are trained under the able direction of Dr. José Dueñas, editor of the monthly review *El Odontólogo,* which frequently publishes papers on subjects pertaining to orthodontics. Another institute similar to that of Buenos Aires is about to be established at Córdoba for children living in the province.

Mention must also be made of the experimental histopathologic research work performed by Dr. Dueñas in 1928 and recently by Dr. Guardo, Jr., who in the review, *Ortodoncia,* published the results of his interesting experiments on dogs under the title "El movimiento Ortodóncico en su aspecto histopatológico" (The Orthodontics Movement in Its Histopathologic Aspect).

In short, the Argentine presents a veritable cultivation of the science and art of orthodontics and among its numerous group of orthodontists (forty) living in Buenos Aires, several are now devoted exclusively to orthodontics.

There are also distinguished orthodontists in Uruguay, among whom we must mention Dr. Oscar Aldecoa and Dr. Hector Damonte, the latter professor of orthodontics. Dr. Aldecoa published in 1933 under the title of *Ortodoncia Práctica* (Practical Orthodontia) a work that may be considered complete. Although the author follows the Angle school ideas, nevertheless he presents, in a brilliant manner, other excellent aspects of the schools of orthodontics with their respective doctrines. Dr. Aldecoa's book is written in a clear, didactic style and is of special interest to the Spanish reader. In the part dealing with histology, the book contains the contribution made by Dr. Dámaso Klapembach who, in cooperation with Dr. Aldecoa, made experiments on young dogs.

The founder of orthodontics in Chile was Dr. A. Manhood. The course in orthodontics is at present given by Dr. Arturo Toriello. This course, which has an independent existence, has been given for approximately ten years. It formerly constituted a section of the Clinic for Crowns and Bridges. There is another course in orthodontics given as a special course by Dr. Rafael Huneeus Guzmán, in which orthodontics is taught in the fourth and fifth years. Dr. Guzmán recently published an interesting study entitled *"Los dientes incluídos y su tratamiento ortodóncico" (Impacted Teeth and Their Treatment by Orthodontics).* In Santiago de Chile there are ten dentists practicing orthodontics, two of whom are engaged exclusively in this branch.

Concerning Brazil, it is only through references obtained that mention can be made here of the Dental Service for Children (Asistencia Dentaria Infantil) at Río de Janeiro, and of the important scientific meetings there held. In Sao Paulo, Drs. Laimo and Luis Stamitis are orthodontists.

A true concern for the development of orthodontics in Venezuela is expressed by the Federación Odontológica Venezolana, which regrets that in the School

of Medical Sciences of the Universidad Central of Venezuela, of which the school of dentistry is a branch, there is no practical work in histology, pathologic anatomy, physiology, microbiology, parasitology, descriptive anatomy, and orthodontics.

In Honduras, the secretary of the Dental Association (Asociación Dental Hondureña), Dr. Carlos Rendón Barnoya, states with honesty: "Orthodontics is not practiced by specialists. Certain cases are attended by sending the models and radiograms to specialized laboratories in the United States who send the appliances already built, together with instructions for their use."

While it is true that in interprofessional relations the ***Orthodontic Directory of the World***, under the able direction of Dr. Claude R. Wood, contributes an important service, nevertheless with reference to Latin America, it is quite incomplete. In almost all the countries of Latin America there are orthodontists or dentists with adequate university training practicing orthodontics. Immediately to the south of Mexico, in the Republic of Guatemala, there are four odontologists who practice orthodontics according to various schools of thought. Among them is Dr. Alfredo Toriello, a former student of the University of California, who specialized in this branch of work.

In Guatemala in the year 1936, the course of orthodontics was established within the School of Odontology. The course is limited to teaching of the general ideas involving the various theories and to practice in the construction of models and bands. Last year the School of Odontology obtained its autonomy from the School of Medicine of which it was a department. With this change in status it hopes to reach the high development of modern odontology.

In 1904 Dr. José J. Rojo, a young, enthusiastic, and distinguished pupil of Dr. Angle, returned to Mexico from the postgraduate course given by the noted American orthodontist in St. Louis, Mo. Dr. Rojo then established for the first time, in the old National Clinic for Dental Training—an annex of the School of Medicine—the course of orthodontics, a subject which up to that time had been ignored in the country. The teaching of orthodontics was included in the course of prosthesis. It must be pointed out, however, that attention was principally devoted to the subject of prosthesis, which covered almost the entire school year, while only a few oral classes were given on orthodontics.

In 1912 in the new Dental School which is today the School of Odontology of the National University of Mexico, Dr. Rojo, who was one of the founders of the new school, established the course in orthodontics. He developed the program of the course with genuine interest and enthusiasm, following, naturally, the teachings of Dr. Angle. Unfortunately, for reasons not pertinent here, Dr. Rojo did not continue with the course for a long time. In 1913 he resigned his position of professor of orthodontics and director of the school. It was at this time that Dr. Francisco Calderón Caso took charge of the course in orthodontics, which he continued to give until 1939. At present Dr. Miguel Díaz Mercado is in charge of this course, which he imparts with true enthusiasm.

The course is divided into the theory and the practice of orthodontics and covers one school year. This time limit of the course still prevails, despite efforts made to extend its duration to two years. Both in the technique and in the

teaching observed in the course, the Angle and the Jackson ideas prevailed. Of course, one school year with its natural interruptions is not sufficient to provide a complete preparation and to awaken the enthusiasm of the students for the subject. For this reason, there was a small number of dentists who practiced orthodontics with more or less success, who were really unable to declare that they were truly familiar with modern orthodontics, and even less with its practice.

The constant effort to progress in the different branches of odontology was noticeable, and with the purpose of studying and improving the technique of orthodontics the Asociación Mexicana de Ortodoncia (Mexican Association of Orthodontia) was organized in 1935. Beginning with a group of ten as founders, the Association has been growing; today it has 20 members. The Association began to develop its progressive program by inviting foreign orthodontists, especially from the United States. Among them came Dr. Brooks Bell, in 1935, who has the merit of having introduced in Mexico the use of chrome alloy and the manner of welding it, both gold soldering as well as spot welding, which, we are happy to state, is employed today almost exclusively with highly satisfactory results.

Among other visiting orthodontists in 1936 came Dr. Spencer Atkinson of Pasadena, a man possessed with great enthusiasm for the science and art of orthodontics. His influence was felt not only among the members of the Asociación Mexicana de Ortodoncia, but indirectly also among the professors of the university. This resulted in improvements in the course of orthodontics given in the School of Odontology, for its professors were members of the society mentioned.

The periodical conventions which the Asociación Mexicana de Ortodoncia organizes with the cooperation of Dr. Atkinson, and the high competency of the national and foreign professionals who annually make contributions to these scientific gatherings, as well as the results obtained thereby, demonstrate the importance that orthodontics is acquiring in our country, both in the professional spheres and in the different social circles.

Scholarships have now been established open to Mexican orthodontists for the lectures in orthodontics at the University of Southern California, which several of us have had the good fortune to attend. We are happy to mention, among the orthodontists who recently came to Mexico, the names of Drs. Atkinson, George C. Chuck, George W. Hahn, George H. Grover, K. F. Terwilliger, John E. Taylor, Will G. Sheffer, Ray McClinton, and dentists as distinguished as Drs. Guy Milberry, Arthur E. Smith, Frank Kaiser, Don Aubertine, Charles Woodward, R. A. Grubb, W. Terrell, and many others.

Sponsored by the Lions Club, and with the cooperation of Drs. Carlos M. Paz, Miguel Díaz Mercado, and the author of this paper, a free Clinic for orthodontics has just been established in Mexico City.

In the Republic of Cuba there is a numerous group of orthodontists under the leadership of Dr. Esteban de Varona, a former pupil of Columbia University. Among the competent and well-known members of this group are Drs. Sergio Guiquel, Andrés G. Weber, Rafael Reineke, and many others.

As happens in all parts of the world, likewise in the countries of Latin America, we find petty divisions among professionals, together with the passionate expression of preferences. There are the orthodox followers of Angle who still continue with his E arch, the modern ones who employ the ribbon arch, and especially those who use the edgewise; the fervent partisans of the biologic school of Mershon with its lingual appliances. The school of Simon with its gnathostatic models and its appliances of rustless steel has also numerous followers. The same can be said of McCoy. The ideas of Atkinson are introduced through his important anatomic studies, especially with reference to research in the human cranium and its immediate application to orthodontics. His appliances are gaining ground due to the good results obtained, and to the use of such a delicate force (wire 0.008) which alone approaches nearest to biologic forces, inasmuch as according to Oppenheim and Kronfeld there exists no appliance by means of which we can apply biologic forces.

In almost all the countries of Central and South America we find dentists who practice orthodontics, many of whom are adequately trained through specialized studies in universities of high prestige, but the majority of these distinguished professionals are often isolated and sometimes unknown.

The friendly contact and the professional relationship among all could certainly have a beneficent influence on the progress of orthodontics in all these countries. Our geographic proximity—as Dr. Varona of Cuba well says—makes necessary the intellectual and economic cooperation of the countries of the Western Hemisphere.

With the purpose of strengthening friendly and cultural relations between orthodontists of North America and Latin America, the American Association of Orthodontists, in August of last year, set out on a praiseworthy labor, the essence of which is expressed in these lines:

"That the American Association of Orthodontists cooperate in the drafting of a program representative of American Orthodontics, to be presented to the next congress of the Pan-American Medical and Dental Association to be held in Buenos Aires.

"That arrangements be made subject to the mutual consent of the members of the Association to hold a conference of orthodontists either in the United States or in one of the Latin America Capitals wherein orthodontics can be taught and discussed with mutual benefit.

"The adoption of this plan is opportune, and it is convenient that the American Association of Orthodontists be the first to establish a firmer cultural understanding with the orthodontists of the other American Republics."

Such a labor of close cooperation and understanding which we sincerely favor would be of positive usefulness to us who practice orthodontics in Spanish speaking America. May this praiseworthy initiative be fruitful in the very near future.

If a current of scientific exchanges, saturated with sincere friendship, such as that shown by Atkinson to the dental profession in Mexico be established, it will mean the realization of the true ideal of Pan-Americanism.

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DENTISTRY AND THE NATIONAL DEFENSE

Brigadier General Leigh C. Fairbank, Washington, D. C.

THROUGH the courtesy extended to me by your society, it is my great privilege to speak tonight to the members of this distinguished organization and your guests. There was a little sentiment and happiness in my heart as we flew from Washington to Louisville today for the pilot of our Army plane is the son of the former Dean of your dental school here in Louisville. This was certain to bring great joy and pleasure and many pleasant memories of the past to many of those present tonight.

Dentistry is facing a big responsibility today. When one sits in the place in Washington where all the plans for medical service are being developed, one wonders where this country will be a year from now. The entire world faces dreadful conditions of war and almost universal plots and schemes to engulf every nation. America must be watchful; it must be awake to the needs of defense.

At such a time, you can well imagine that the pages of dental history have been turned back to see just what occurred in 1917. At that time the Dental Corps of the Army consisted of eighty-six officers. You recall the splendid spirit and the great sacrifices manifest by dentists at that time as national defense and mobilization became the great purpose of our nation. We had nearly five thousand dental officers in the Army before the war was over. Theirs was a wonderful record of achievement. The accomplishments were outstanding and the inspiration of the Dental Corps through all the subsequent years. Today is another age—dentistry is a different profession—the accomplishments of the last twenty years have been the most outstanding in all our history. In the plans for the future, whatever they may be, you would expect many changes for the better in the dental service established at the time of mobilization. Perhaps the most essential change has been provided in our plans for a dental service twice as large as at the time of the World War. Our plans today, when compared with the plans of the last war, show improved training efforts, new organizations, an entirely new type of equipment and supplies, and the entire modernization of dental service. This has been done to assure the finest dental service for our soldiers. Dentistry must make a real effort. It must assure us of accomplishments of which we as professional men might be proud.

It is one's bounden duty to recognize those forces in dentistry which have contributed so greatly to our advancement in the last twenty and more years. It was natural that we should turn to the American Dental Association, and in all the plans to assure us an effective program, the influence of the American Dental Association is projected through every activity. Side by side, shoulder to shoulder, we are working to assure the achievements and the glory which can come to our profession when energetic and determined men enter into a program for professional accomplishment.

Address delivered October 24, 1940, Brown Hotel, Louisville, Ky.

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As an outward evidence of that desire and its effectiveness in the American Dental Association, at the meeting in Cleveland, several things were done to assist in the program. A *questionnaire* was authorized which has been sent to every dentist throughout the country, except the recent graduates—an error which will be corrected. This questionnaire included many important questions and essential personal information which was desired for the Association in their cooperation with the War Department. Some of these personal questions have created some comment, disturbing some people. It seems that some felt it was too personal—something like the 1940 census! Among the questions asked were some relative to those who would volunteer for military service under the present plans of mobilization and training. It was anticipated that a large number would volunteer (between the ages of 23 and 36) who could leave their practices for a year; men with no families, those with independent incomes. It was also desired to learn how many would volunteer for service in time of war (men between the ages of 23 and 55 years). Questions were asked relative to financial obligations, family responsibilities, affiliation with hospitals and dental schools.

All this was done for a purpose—to protect those men who had responsibilities or commitments. It is known that it would be a tremendous financial sacrifice if some were called to military service. It was all done in a spirit of helpfulness, for organized dentistry is anxious to assist in the mobilization of dentistry for national defense and accomplish the big program without hardship to anyone. It is a sacrifice for one to lock up one's office to meet a call such as is being made today. It was in consideration of this possible difficulty that it was decided best to secure this information so that it might be used for *your* benefit. The American Dental Association has mailed the questionnaire to 72,909 dentists throughout the country. In a telegram received by Dr. Oliver today, it was learned that 31,263 of the questionnaires have been returned to the Central Office of the A. D. A. by noon today—44 per cent return! This indicates just how willingly and splendidly the dentists of the country are responding to this excellent program of the A. D. A. It is particularly encouraging for 32,000 were mailed from the Central Office in Chicago to dentists in several states less than a week ago. It is certain that none of them have been returned to date. This cooperation of the American Dental Association and thousands of the dentists of the country is deeply appreciated by the Government.

With this as an introduction, we will get down to the meat of this subject. A majority of you, and certainly all those who are under 36 years of age, are wondering what will happen to you in this Selective Service, induction into the military service, and the mobilization of dentistry for national defense. On the sixteenth of this month, every dentist of military age in this country was required to register. Some of these men have reserve commissions—they won't have to worry—for they will not be inducted into the services; they will be ordered to active duty as dental officers when the Government needs them—don't worry about that! We must have nearly 2500 dental officers around the first of the year; the total number will be 3,000 by April 1, 1941. The Government will get them, and dentistry must be prepared to meet this need, for when

mobilization starts, it rolls right along. In fact, it is a program of mobilization which covers a period of five years and the Government is certain to call for 3,000 dentists per year over this entire period—a total of 15,000 dentists! This is sure to affect dentistry in a very large way, but the Government has wisely planned this project so that it will not interfere with dental education, with dental service for the public, or with the development of our profession, if the cooperation of every dentist in the United States is assured through the questionnaire and survey being made by the A. D. A.

For the dentists who have registered and do not hold Reserve commissions and who may be called to military service—there's the rub. A letter was handed to me today, coming from a news agency in Washington, in which it was said that the dentist who is drafted will enter the Army as a private soldier—$30.00 per month. That is a terrible shock to a lot of people; it is a terrible shock to dentistry. It is equally a shock to medicine, for medicine is treated in exactly the same way. Don't think there is any difference in the consideration given either of the two professions, for there is none. This is a great national effort—a tremendous effort on the part of our democracy for national defense. It is certain that through the questionnaire to the A. D. A., and from evidence in our component societies there will come from the hearts of our true Americans in the dental profession, a great desire to set their houses in order and to make plans for a year of military service. The call may not come for this year, your turn may arrive next year; the chances are that you will certainly be called some time during the five years. The present Dental Reserve will not provide the needs for the next two years. In fact, it is doubtful if it could possibly supply us with the needs of the present mobilization for 1940-41. Only the captains and lieutenants will be called to active duty at this time. This means that out of the present reserve of 4,300, only about 3,500 would be eligible for duty at this time. Of this number a large percentage cannot pass the physical examination. The quota required each year should come from the voluntary applications of those who ask for a year of service and those who may be inducted into the service.

A bill was presented in Congress this month providing that every physician and dentist who is drafted would automatically receive a commission in the Medical or Dental Corps Reserve. Regardless of his qualification—unmindful of his physical qualifications, his ethics, his professional standing, or his professional ability—the physician or dentist would be given a commission and fulfill his obligation (?) in this mobilization for national defense. This would have been very detrimental to both medicine and dentistry; it would greatly affect the efficiency of the medical service organized to meet the needs of the large Army set up for training and defense. There must be a better way to meet this problem.

The dentist inducted into the military service as a private may make an application for a commission in the Dental Reserve Corps. His application will be considered by a board of officers. The board will inquire into his professional qualifications. Through the Military Affairs Committee of his state, information will be secured as to the standing of each one. We want to know about the dentist in his community; we must know what his confreres think of him;

his college Dean can give us an excellent estimate of the candidate. These are important factors in securing a sound opinion from the examining boards. We must have a splendid dental service to care for the dental health of this large Army. We are of the opinion that every true American is of the same opinion, and that every honest dentist in this land will approve such a method in the treatment of the dentists who may be inducted into the Army in this process of Selective Service.

There is one point to clear up in connection with the selection of dentists for reserve commissions. Every honest dentist will agree that only the best men should be commissioned. The interest of each dentist in dental progress and professional worth largely determine his professional outlook. Interest and active work in organized dentistry are influences in one's professional progress. Do not misunderstand me, but it is very clear that any dentist who does not regard his professional standing nor seek the advancement which affiliation with organized dentistry will bring, cannot imagine that the Army will hold his professional value very highly. There is nothing in Army Regulations which says that a dentist must belong to the American Dental Association to qualify for a reserve commission in the Dental Corps. My great hope is that American dentists will be proud to maintain their membership in the American Dental Association at this time. I do not have very much use for a dentist who does not belong to the American Dental Association. Our Association has made American dentistry the standard of the world! It has been the aid and the inspiration to every man in our profession; it has placed each of us in a position of influence and its high standard has made possible the great accomplishments in our desires to meet human needs in our generation.

There is one source for the procurement of dentists for military service at this time which is filled with possibilities. The young graduate is faced with doubt and uncertainty. He has registered; he has hesitated about establishing himself in practice. There is the possibility of civil practice on the one hand and compulsory military service on the other. We have endeavored to encourage the young graduate to apply for a reserve commission and extended active duty for one year. This accomplishes several important things for him: it solves his problem in several ways, for he thus meets his obligation as an American citizen; he embarks upon his professional career under the most favorable circumstances at the same time; it permits him to plan for definite entrance into civil practice with certainty the following year without the possibility of interruption, except in time of war. It also assures him of a better income than that usually enjoyed during the first year subsequent to graduation. Many of the June graduates have received reserve commissions and are now on active duty; we will undoubtedly secure a great many more.

Just a word of advice to the recent graduates who are about to open their own offices. You have dreamed of this occasion during all your undergraduate years. As a first lieutenant in the Dental Corps, your salary would be $3,000.00. To most of us in the practice of dentistry, thinking back to our first year of practice, $3,000.00 was something! In my first year I had forty-five patients—I know there are a great many here tonight who didn't have many more than I did! After having served the one year in the military service as a dental reserve

officer, you can then enter upon your career in civil life with a few hundred dollars, you can establish credit in a much better way, but best of all, you can take your place in your community as a citizen who has fulfilled his obligation to his country. You will be a better dentist, a better citizen, and a better man for having placed your duty to country first.

Dean O'Rourke has made a study of dental education and some facts disclosed by him are important in our consideration of the procurement problems of dental personnel required for mobilization. He states that during the last decade the dental schools graduate only about 1800 dentists per year. The Army can anticipate that of that number a certain number will be physically disqualified; another group will be exempted for other reasons. It is estimated that about 1,000 would qualify for active military service. This is very important to the dental profession and to the needs of our Nation, for we as a profession must recognize our responsibilities to the public in such a time of national need. Dental service must be available for the public, for the hospitals; dental professors must be maintained for our many teaching and research staffs in all our colleges and other institutions. The Nation is certain to require 3,000 dentists for military service each year. It is our desire to secure these dentists without demanding great personal sacrifice, without depleting dental service in any community, and without interfering with dental education. The mobilization of dentistry for national defense can very easily upset the entire dental structure. The American Dental Association has given serious thought to these and many other important problems in this National Defense Program. At no other period in all the history of organized dentistry has there been such great cooperation between the dental agencies in Government and the American Dental Association. It has been done first because of our responsibilities as citizens and secondly because of its great desire to secure every consideration for its members. It has provided opportunity for service; it has assisted the Government in many important ways; it has represented dentistry in Congress and before important committees; it has protected those who have personal responsibilities and civil commitments; it has provided plans for the adequate dental care of the public; and it has made a major effort to assure the maintenance of dental schools and the dental staffs of hundreds of hospitals. The functions of organized dentistry in time of mobilization are of tremendous importance and but few of our members appreciate the responsibilities which the American Dental Association has shouldered for the benefit of the nation and every member of the Association.

Military dentistry is sure to awaken a lively interest on the part of every dentist in the entire country during the next five years. In the first place, the dental officer is a Medical Department Officer. Some people have never understood just what this means. For one, I believe dentistry is a part of medicine; a specialty, just as much as the throat specialist, the heart specialist, or any other specialist who treats some part of the body to restore normal physiologic function. We talk of dentistry as an essential health service. It is imperative that we make it so—and strange as it may seem, in the Army, our being in the Medical Department gives us a particularly fine opportunity for us to develop that trend. In our organization, training, and service, our officers are

first essentially Medical Department officers. There are many responsibilities which we must share with medical officers, both in camp and on the battle field. We not only *can* fulfill this function but we *must*, if we want to see dentistry come into the great place in the field of medicine that we feel it should occupy.

In our training camps, during the coming months, our dental officers will complete a schedule of training over a period of a few months with the medical organizations in the combat divisions. Having completed this training, they will be transferred to large camp dental clinics where they will undergo professional training while rendering necessary dental service to military personnel. The plans for this service, the supervision and the facilities for this service are all exacting and in accordance with recognized methods of modern dentistry. The last stage of training will cover dental service in hospitals; a type of service which will greatly enlarge and benefit every dentist called to military service. Our training camps will not be similar to the old Camp Greenleaf of the last war; some of you remember that camp! Today we do not believe in that sort of thing. The whole program will be one which will insure the enthusiasm, devotion, and loyalty of every dentist in the military service and its far-reaching influence will be reflected in the professional career of every dentist through the years to come.

Democracy in action should be expressed by our nation as we mobilize for national defense. It should be the expression of our millions of citizens, in which we accept our duty with that spirit which exemplifies the noble traits of a free people. It must be the manifest expression of the dental profession if it is to be worthy of our heritage. Not only those who serve in the Army but those who remain at home have their duties and responsibilities in the national defense program. Many expressions have come to the War Department from members of our profession who are too old for military service, physically disqualified, and unable to serve actively in the Army for other reasons. Some can serve on medical advisory boards and induction boards and will thus serve their nation in a splendid way. But for the entire dental profession, there is an obligation toward the nation, its people, and for those who are called to service with the Army.

While in Southern California a few weeks ago, the question arose: How about the dentists who are called to military service, what happens to their practices? This is a problem. The Government has given thoughtful planning concerning the problems of the man inducted into the military service. The law requires that his employer must guarantee that he will get his job back when he returns. The white collar worker on the other hand is called to the military service and the Government appeals to his employer to make up the difference between his army pay and his usual income as an employee; this in spite of the fact that business will be called upon to pay excess profit taxes. The professional man, however, takes his stock in trade—his education and his skilled fingers—and enters the Army. The doctor locks up his office, leaves his established practice and fulfills his obligation as a citizen! When he returns, his practice is gone! In Southern California, they sought a sensible and honorable solution to this problem. We like to think of our profession as altruistic in motives and that it possesses deep patriotism and the fine spirit which should

be manifest by professional men. It seems to have been expressed in the plan developed in Los Angeles.

When one of their members is called to the military service, he sends a list of his patients to the office of secretary of his society. Notices are sent to each patient by the secretary, advising them that their dentist, Dr. Smith, has been called to the military service and the local dental society, through the secetary's office, will be glad to assist them when they are in need of dental service. The members who are not called to military service volunteer to assist in the care of those patients of members called to active duty who require dental care. Mrs. Jones, one of Dr. Smith's patients, needs dental services and calls the association's office, advising them of the difficulty. The secretary arranges for an appointment and makes a record of the call. As different patients call, the secretary secures appointments for them by distributing the calls to the various names on the volunteer list. When Dr. Smith returns, upon the completion of his military service, the secretary notifies the patients of his return and sends Dr. Smith a list of all the dental service given his patients during his absence that have been cleared through the office. This is a splendid plan and displays that fine professional spirit and the desire to protect the interests of those who are called to military service. I commend this plan to you for your thoughtful consideration.

Dentistry faces many knotty problems in connection with national defense and the mobilization plans which are to continue for the next five years. It is certain that every dentist in the Nation will be affected in some intimate way. In all our efforts, let us determine that we will do that which every good American citizen should do; that which every good American dentist should do. Let us determine that we will meet each problem intelligently, faithfully, and honestly. Let us endeavor to accomplish something for our profession which will prove the value of American dentistry. To those who are called to active military service, remember when you leave your office and put on your uniform that you assume the greatest responsibility of your entire life, for your nation, for your profession, for your family and for yourself.

Questions and Answers

Q. I didn't receive one of the questionnaires?

A. I don't work in the Central Office of the A.D.A. [The questioner was a recent graduate; questionnaires will be mailed to them later.]

Q. What is the status of orthodontia?

A. You will not practice orthodontics in the Army. A special assignment will be given to orthodontists, such as chief clinician in the camp dental clinics, etc. The orthodontists will not be assigned to denture work, restorations, etc.

Q. What are the possibilities of remaining for an extra year?

A. That is a good question. Some dental officers are going to remain two years—it will help to solve this problem which will face us each year to secure 3,000 dentists for military service. Dental officers will have to ask for the extra year and their records for the first year will have to be satisfactory if they are to receive favorable consideration. Some may ask "Can I stay the whole five years?" The answer is "No." The reason is that we must train approximately 3,000 dentists each year and when the five-year program is completed, we hope to have 10,000 dentists trained in military dentistry. Some may ask what is the chance of getting a commission in the Regular Army. There is no law to

provide a commission in the Regular Army under these circumstances. If you are less than 32 years of age, if you pass a competitive examination, and there are vacancies in the Dental Corps, Regular Army, you may qualify for an appointment. At present there are no vacancies. Your service as a reserve officer has nothing to do with it; you must pass a competitive examination. No examinations will be held insofar as I know during the next year.

Q. I would like to know the procedure in making application for a reserve commission.

A. Write to the Corps Area Dental Surgeon in your Corps Area; Kentucky dentists should write to the 5th Corps Area, Fort Hayes, Columbus, Ohio. (Tennessee dentists write to the Corps Area Dental Surgeon, 4th Area, Atlanta, Ga.). Request application blanks for a reserve commission. The necessary blanks should be filled out and all instructions closely followed. Commissions will not be given unless you volunteer for one year of active duty.

Q. I am 37 and I want to join the Army. What shall I do?

A. You must wait until a war is declared! No one is commissioned at present who is over thirty-five. We hope to raise this to 36. In time of war the bars are down and we will consider any application from dentists up to 55 years of age.

Q. If you are drafted, what chance is there of getting a commission?

A. I think I explained that. If you are drafted, you must enter the Army as a private soldier. You may, however, make an application immediately for a reserve commission in the Dental Corps. You will be called before a board of dental and medical officers for an examination. It may require two or three months for you to secure your commission.

Q. I am a visitor here, a physician, and a "graduate" of Greenleaf. I have been recommending to my young medical friends that they purchase a military medical manual. If I had had one at Greenleaf, it would have been very useful. I would like your opinion of it—the military medical manual put out by Carlisle?

A. A very good idea.

Q. If a private gets a commission, he will be promoted to what?

A. If a dentist inducted into the military service as a private appears before a board to consider his application for a reserve commission and that board approves his application, he will be commissioned a first lieutenant.

Q. Suppose you are a first lieutenant now.

A. You will probably be a first lieutenant!

Q. What is the status of dental and medical students in the draft, and what is your advice to them?

A. They will not be drafted prior to June 30, 1941. After that plans now under development will become effective. We must have medical and dental schools. We must encourage more dental students. It is an imperative necessity. As this program goes over, this Nation is going to see the benefits which come from better dental service, reaching more people, and there is going to be a demand for better dental service. It will be necessary to protect our medical and dental schools. Also our medical and dental interns are to be protected. We must make a definite effort to encourage that. You may be sure that is one of the problems which the Surgeon General is determined to solve.

[Hearing no further questions, the General continued:]

I trust you realize how earnestly we have endeavored to solve these many problems before dentistry. We have a great opportunity; an opportunity to do something in regard to the health of this Nation that has never been done before. We have an opportunity to find out something about dental diseases in large groups of adults. All the previous group studies have been done with children. Dentistry will profit by the complete dental survey of one and a half million men which will be done annually as a dental activity in connection with the mobilization program during the next five years. This will be of inestimable value to the profession.

To the dentists who enter the military service, do your best; be proud that you are a dentist; make the Army proud that you are a dental officer. Strive to make the accomplishments of dentistry something outstanding! It will guarantee this—when the five-year program is completed, dentistry will be recognized in this land as never before. Our oral surgeons will enter any hospital in the country and be recognized as men of accomplishment, men to be trusted. In the Army they will be thrown closer to the medical profession. It lies within the power of our dentists who enter the military service to accomplish something for our profession and the health of our nation. All medical service is directed to that end—to meet human needs. While we are laboring for the defense of our Nation we can also build for our profession—the profession we love!

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HISTOPATHOLOGIC STUDIES OF ABNORMAL ENAMEL FORMATION IN HUMAN TEETH

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IN THE course of a histologic study of the teeth and supporting structures in a series of infants and human fetuses, certain abnormalities in the ameloblasts and organic enamel matrix have been observed.

Little attention has been given to the histopathology of the initial stage and its sequence in the histogenesis of enamel hypoplasia. The findings in the present report may represent such changes.

A detailed clinical description of enamel hypoplasia was made by Hutchinson[1, 2] although the dystrophy had been mentioned in the literature for many years previously.[21] In later years, these lesions were investigated by Zsigmondy, Berten, Walkhoff, and Erdheim who showed particular interest in their nature and histogenesis. With the exception of Erdheim's, most of the studies were made of ground sections of human hypoplastic teeth. Consequently, the conclusions regarding the earliest histopathologic changes were largely conjectural and numerous theories were advanced.

Zsigmondy[3] referred to a decay of the ameloblasts corresponding in location to the pits in the enamel. Berten[4] believed that an incomplete calcification of the surface layer of rods along the lines of Retzius was the mechanism of hypoplastic formation. Walkhoff at first supported this view, but later stated[5] that the probable cause was a primary injury to the ameloblasts by microorganisms. Later, Gottlieb[6] made a detailed histologic study of enamel hypoplasia in rickets and concluded that the lesion resulted from a "crumbling" of normally formed but defectively calcified "elementary substance." The degeneration of the ameloblasts was, he believed, a secondary change due directly or indirectly to the defective deposition of calcium salts.

Although some investigations have been made in this field, there is still a need for further study before the nature and early development of these lesions can be completely understood.

Erdheim[7] and Toyafuku[8] both described changes in the rat incisor following parathyroidectomy. These changes closely resemble those observed by Diamond and Weinmann[9] in a syphilitic fetus. Schour and Smith,[10] in the course of an experimental study of fluorosis in rats, attempted to find the earliest lesions in

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the incisor teeth that could be detected histologically. They reported severe alterations in the appearance of the ameloblasts and a deposition of enamel globules on the surface of the organic enamel matrix. Mellanby[11] observed similar changes in the developing teeth of puppies given a rachitogenic diet. In her monograph, she states that the ameloblastic layer is markedly altered in appearance and sometimes secretes an enamel substance with the formation of "enamel nodules." Klein[12] studied the teeth of swine and rats fed a rachitogenic diet and noted a destruction of ameloblasts which he believed was due to the penetration of an edematous fluid between the individual cells.

These observations, with the exception of those reported in the monograph by Diamond and Weinmann, were made on experimental animals.

MATERIAL AND METHOD

The material upon which this report is based consists of five cases. Six others of similar age groups served as controls. Roentgenographs were available for some of the cases here reported.

The histologic technique employed in the preparation of the material is described by Burket.[14] Serial sections were cut and every tenth section mounted and stained with Delafield's hematoxylin and eosin.

Findings

For purposes of comparison with the abnormal, a brief description will first be made of one of the normal cases from the control group.

The material is from a male infant born two months prior to term of a 21-year-old primipara. Labor lasted three and one-half hours and was normal and spontaneous. The child weighed six and one-half pounds at birth and seemed to be normal with the exception of considerable moulding of the head, a yellow discharge from the right eye and a moderate phimosis. Four days after birth the infant suddenly expired. The clinical diagnosis was possible intracranial hemorrhage from hemorrhagic disease of the newborn, phimosis, and chemical conjunctivitis.

No unusual changes were observed in any of the teeth studied. The mandibular right first deciduous incisor (Fig. 1) shows the typical appearance of ameloblasts and enamel matrix. The cells are regular in form and their nuclei are located at the peripheral portions proximating the stratum intermedium. The uniform surface of the underlying enamel is clearly seen paralleling the uninterrupted basement membrane of the ameloblastic layer.

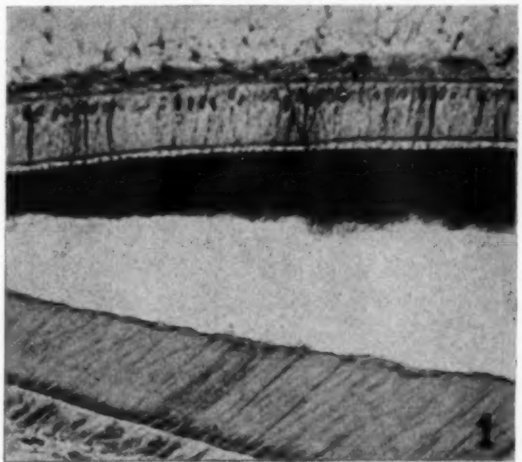
The following five cases, in contrast with the normal, show striking changes in the ameloblasts and organic enamel matrix.

Case 1

A. *Clinical History.*—A full-term stillborn of a mother with a history of fourteen previous pregnancies. Eight children are living and well. After the onset of labor pains, a diagnosis of placenta praevia was made. Fetal heart sounds were not heard after extraction of the child.

B. *General Pathologic Findings.*—The body was that of a well-developed full-term female infant, weighing 3825 grams and measuring 71 cm. in length. Nothing of significance was found in either the gross or microscopic examinations.

C. *Dental Pathologic Findings.*—The entire mandible was removed for study and roentgenograms taken. Following celloidin embedding and decalcification the jaw was divided in the median line and the right anterior region preserved for examination by gross dissection. Histologic sections were prepared of the remaining tissues.



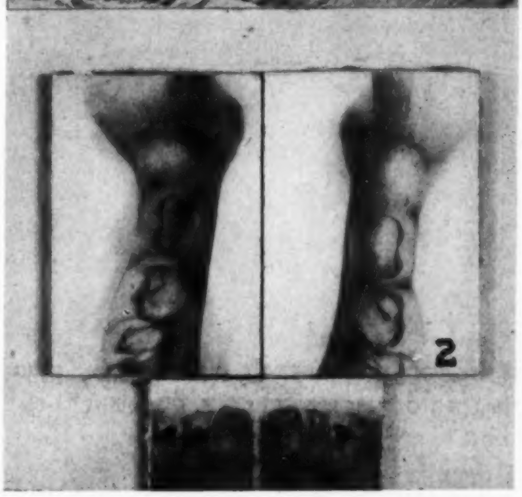


Fig. 1.—Cervical region of the mandibular right first deciduous incisor showing the normal appearance of ameloblasts and organic enamel matrix. (×200.)

Fig. 2.—Roentgenograms showing the anterior and posterior regions of the mandible with the deciduous teeth and first permanent molars visible in their usual position and some evidence of calcification in the mesial cusp regions of both permanent molars.

1. *Gross Examination.*—Nothing unusual was noted at the time of autopsy. The gingival tissues were intact and the arch well formed.

On dissection, the right central deciduous incisor was seen embedded in its follicle. The enamel was brown in color and measured approximately 0.4 mm. in greatest thickness at the incisal portion. It was firmly adherent to the surrounding epithelial lining. The dentine had a yellow color and was everywhere thicker than the overlying enamel. The dentine and pulpal tissues were peeled away from the enamel with ease, exposing smooth, shining surfaces of the dentino-enamel junction. The enamel was soft and friable and the dentine firm and elastic. Both structures were translucent. The dentine was removed from the

underlying tissue leaving fairly smooth surfaces. The second deciduous incisor and canine were of similar appearance. No gross defects could be demonstrated.

2. *Roentgenologic Examination.*—Roentgenologic examination (Fig. 2) showed the anterior and molar teeth in their crypts and some evidence of calcification in the mesial cusp regions of both first permanent molars.

3. *Histologic Examination.*—Changes in the enamel matrix and ameloblasts were observed in all the deciduous teeth and both first permanent molars. Many ameloblasts in the lingual cusp region of the right first deciduous molar (Fig. 3) were vacuolated in appearance. These cystic changes involved individual and groups of cells so that the vacuolated areas varied greatly in size. Many were seen to contain malposed pyknotic and karyolytic nuclei. Projecting from the inferior borders of the vacuoles and crossing the interrupted basement membrane were streaks of material which stained similarly to enamel. Covering the uniform surface of the normal appearing enamel matrix, and sharply separated from it, were granular, globular, and irregular masses of enamel-like substance. In many areas these were seen to be continuous with the projecting streaks from injured ameloblasts. The sharp terminations of the subjacent normal appearing enamel rods were clearly seen. Similar changes were observed in the buccal cusp region (Fig. 4).

At *A*, Fig. 4, is a notch-like defect in the enamel with a corresponding invagination of the overlying ameloblasts. There is no sharp demarcation between ameloblasts and stratum intermedium in this area. The possibility is considered that this may represent an artifact.

A higher power magnification of cystic changes in the ameloblasts of the right second deciduous molar (Fig. 5) permits a more detailed study. The vacuolated areas appear, in many instances, to involve groups of ameloblasts. Displaced pyknotic and karyolytic nuclei are observed, and the adjacent cells are crowded to either side. Extending from the inferior borders of the cysts are the streaks of dark purple staining material which cross the interrupted basement membrane and are continuous with the irregular masses and globules overlying the uniform surface of enamel matrix. Identical changes are observed in the ameloblasts and on the surface of enamel matrix in the first permanent molar.

The left central deciduous incisor showed the more striking changes in the ameloblasts although the granular surface of the enamel matrix was quite evident in the incisal third of the lingual surface. Many of the enamel-like globules contained in the ameloblasts were continuous with the granular layer. These lesions were more prominent in the lateral incisor (Fig. 6). To the left in Fig. 6 is a small area of vacuolization in the peripheral portion of one cell. The remaining secreting ameloblasts are not cystic in character.

The remainder of the teeth on the lower left side showed similar cystic changes, enamel-like projections across the basement membrane, and granular deposits on the enamel surface (Figs. 7 and 8).

Dentine, pulpal tissues, and supporting structures were of normal appearance.

Case 2

A. *Clinical History.*—A female stillborn of a 28-year-old mother. Nothing unusual was noted about the pregnancy. The mother was in labor for sixteen hours and fetal heart sounds were heard within ten minutes of delivery.

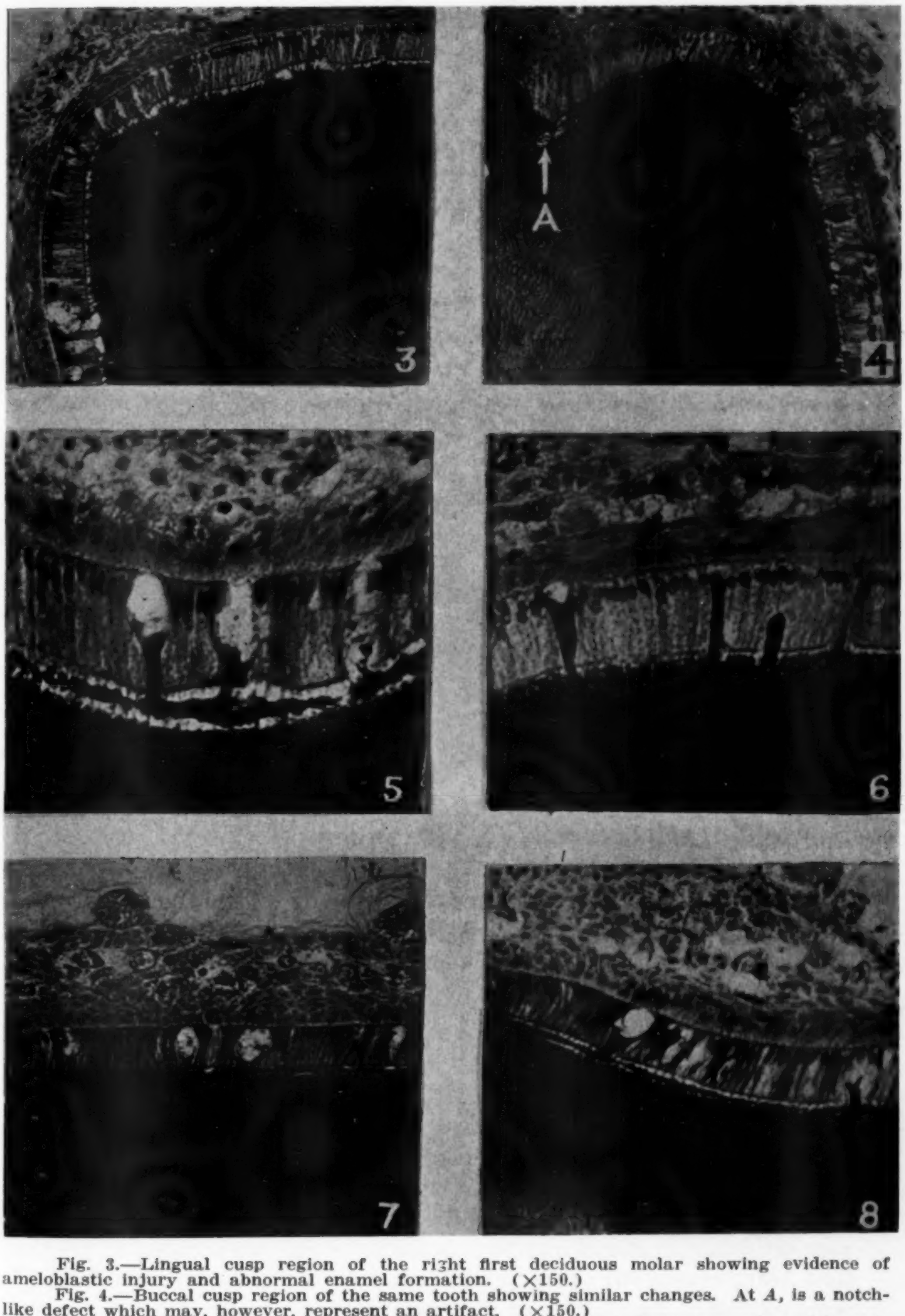


Fig. 3.—Lingual cusp region of the right first deciduous molar showing evidence of ameloblastic injury and abnormal enamel formation. (×150.)

Fig. 4.—Buccal cusp region of the same tooth showing similar changes. At *A*, is a notch-like defect which may, however, represent an artifact. (×150.)

Fig. 5.—A higher power magnification of the right second deciduous molar. There is marked evidence of cystic change in the ameloblasts and formation of an irregular enamel-like material on the uniform outer border of normal enamel matrix. Projecting streaks of dark staining substance from the cystic cells are continuous with the abnormal deposits. (×300.)

Fig. 6.—Left second deciduous incisor showing streaks of enamel substance in the protoplasm of ameloblasts. To the left is seen a small vacuolated area in the peripheral portion of such a cell. Subjacent to the ameloblastic layer is a granular zone of enamel-like material. (×300.)

Fig. 7.—The left deciduous canine showing marked vacuolization of the ameloblasts and enamel-like projections toward the underlying granular zone. (×200.)

Fig. 8.—First deciduous molar showing identical lesions. (×200.)

On physical examination the baby was well developed and apparently full term.

B. *General Pathologic Findings.*—There was almost complete bilateral atelectasis of the lungs, a small crepitant area being felt in the right lung. Ecchymosis and excoriation of the vulval and perianal regions and congestion of the viscera were the only other findings.

C. *Dental Pathologic Findings.*—The right half of the mandible was removed for study, and histologic sections were prepared. The teeth included in this specimen were the five deciduous teeth and first permanent molar distal to the median line. Roentgenograms were not taken.

1. *Gross Examination.*—No teeth were visible and the mucous membranes were smooth and intact.

2. *Histologic Examination.*—The changes observed were similar to those described in the previous case. They were more marked in the molar teeth.

The ameloblasts in one region of the mesiobuccal cusp of the mandibular first permanent molar (Fig. 9) had lost their usual morphologic appearance. No distinct cellular structure was visible, and the nuclei were small and displaced. A light purple staining material projected inferiorly from the cellular substance and spread bandlike over the uniform outer border of the normal appearing enamel from which it was sharply separated.

The mesiolingual cusp region of the same tooth (Fig. 10) showed many groups of ameloblasts destroyed and missing in regions where projections from the enamel surface extend into the ameloblastic layer.

Other sections studied showed inclusions of light purple staining material in the ameloblasts. These frequently projected inferiorly toward the surface of the enamel matrix. Marked vacuolization of many of the ameloblasts with centrally located, pyknotic nuclei were also observed.

The pulp tissues showed marked vascularity and many capillary loops were seen in the odontoblastic layer between the individual cells. Some hemorrhage was seen in the tissue spaces at the basal portion of the dentinal papilla.

The outer enamel epithelium, stellate reticulum, stratum intermedium, and dentine were of usual appearance as were the gingival tissues, bone, and bone marrow.

Case 3

A. *Clinical History.*—A full-term female stillborn of a 26-year-old mother, with a history of three previous pregnancies. A diagnosis of rheumatic heart disease was made six years previously. Two weeks before the present admission the mother's feet and abdomen became markedly edematous. There was a 2+ albumin and a blood pressure of 154/106. On admission, the membranes were artificially ruptured and labor began two hours later. Loud and regular fetal heart sounds were heard at this time. Eight hours later the head was engaged, and it was noted that the umbilical cord was wound twice around the child's neck. The cord was clamped and cut and delivery completed. The child did not breathe and attempts at resuscitation were unsuccessful.

B. *General Pathologic Findings.*—At autopsy, the body was well developed. The only findings of significance were bilateral congenital pulmonary atelectasis,

hemorrhage into the subarachnoid space and tentorium cerebelli, petechiae in the pleura, and cyanosis of the head and neck.

C. ***Dental Pathologic Findings.***—The entire mandible was removed for study and histologic sections prepared of all the teeth present.

1. *Gross Examination.*—The tissues were of usual appearance. No teeth were preserved for study by gross dissection.

2. *Roentgenologic Examination.*—Roentgenograms were taken of both maxilla and mandible at the time of autopsy and showed a similar picture to that seen in Fig. 2. All the deciduous teeth were visible in their crypts and the mesial cusp regions of the first permanent molars showed some evidence of calcification.

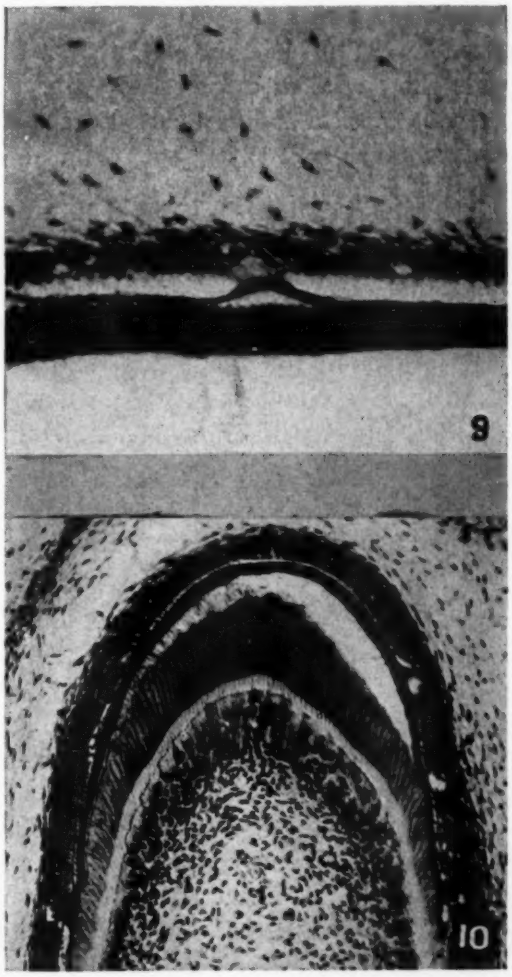


Fig. 9.—Mesiobuccal cusp region of the mandibular first permanent molar showing projection of enamel-like substance from an area of injured ameloblasts. (×250.)

Fig. 10.—Mesiolingual cusp of the same tooth showing projections of enamel material into the ameloblastic layer. (×150.)

3. *Histologic Examination.*—Marked changes were observed in the ameloblasts and organic enamel matrix of all the deciduous teeth and both first permanent molars. Irregular masses of enamel substance overlay the uniform outer border of enamel matrix in the right first deciduous incisor (Fig. 11). The ameloblasts in this area were for the greater part regular in appearance, with

here and there a small peripherally located vacuole. Numerous cracks in the formed enamel matrix may represent artifacts. Many of the larger enamel-like masses subjacent to the ameloblastic layer had a striking honeycombed appearance. Such a mass is clearly seen in the right deciduous canine (Fig. 12). The uniform terminations of the enamel rods of the normal appearing enamel matrix made it unlikely that this irregular structure was a result of the plane of the section. An artifact was present between the two structures. Many ameloblasts showed cystic changes with crowding of the adjacent cells. The basement membrane was intact.

Small globules are present in great number in the cytoplasm of the cells of the right first deciduous molar, Fig. 13. To the right is a large vacuolated area. Underlying the ameloblasts are larger irregular globules of enamel-like material. Similar changes are seen in the ameloblasts of the right first permanent molar (Fig. 14). All the cells show marked evidence of injury. Droplets of irregular size and shape are contained in the vacuolated areas and on the surface of the formed enamel matrix. The cells comprising the stratum intermedium are regular in appearance. Definite cystic changes are similarly observed in the left second deciduous incisor (Fig. 15). Subjacent are seen many dark blue staining droplets and to the left, a large mass of homogeneous dark staining material. The surface of the formed enamel matrix is uniform and of normal appearance.

The left first deciduous molar (Fig. 16) shows, under higher magnification, the markedly cystic appearance of the ameloblasts and large masses of enamel material overlying the uniform terminations of the enamel rods.

No changes were observed in any other of the dental structures.

Case 4

A. *Clinical History.*—This female infant, born normally of a healthy mother, showed no abnormalities at birth. Twenty-four hours later it appeared jaundiced, became increasingly cyanotic with difficulty in respiration, and died fifty-seven hours after birth.

Both the mother and father were of Italian stock. The mother had two previous pregnancies, both children living and well.

The laboratory findings were as follows: Red blood count, 2.53 with 14 per cent megaloblasts and 65 per cent normoblasts. The hemoglobin was not recorded. The white blood count was 24,600, with 3 per cent myeloblasts, 2 per cent myelocytes, and 7 per cent unclassified. The icteric index was 200, and the fragility test was within normal limits. The Wassermann reaction was negative, as was the blood culture.

The clinical diagnosis was erythroblastosis.

B. *General Pathologic Findings.*—The skin and sclerae were jaundiced. There was a marked icteric tinge to the myocardium, liver, adrenals, kidneys, and brain. The lungs showed many circumscribed, sunken, dark-red, atelectatic areas.

On microscopic examination, the lungs were seen to contain many small areas of focal hemorrhage, chiefly intra-alveolar. The spleen was congested, and scattered throughout were many golden-brown, pigment-containing mononuclear cells. In the liver were many foci of active hematopoiesis with

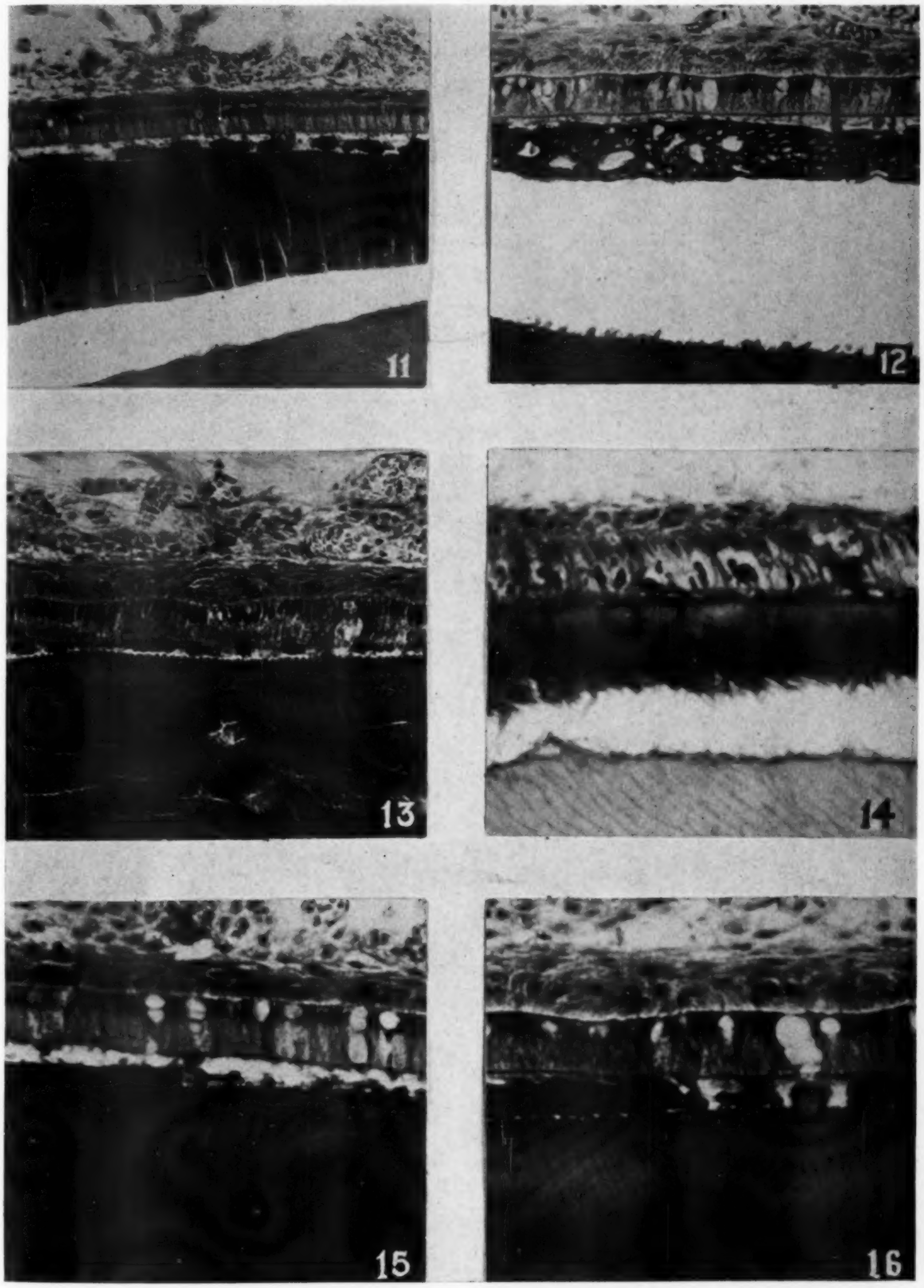


Fig. 11.—Right first deciduous incisor showing the relatively uninvolved layer of ameloblasts and the subjacent irregular masses and globules of enamel-like material. (×125.)

Fig. 12.—A higher power magnification of a large irregular mass of blue staining material underlying the ameloblasts in the right deciduous canine. The markedly honeycombed appearance is clearly seen. An artifact separates the normal enamel matrix. (×220.)

Fig. 13.—Right first deciduous molar showing numerous small droplets in the protoplasm of the ameloblasts and large irregular globules of dark blue staining material overlying the uniform outer border of enamel matrix. (×220.)

Fig. 14.—A high power magnification of the right first permanent molar showing marked evidence of cell injury with irregular droplets of material in the cystic areas. The granular zone of enamel is seen subjacent to the ameloblastic layer. (×400.)

Fig. 15.—Marked degree of vacuolization of ameloblasts and large deposits of dark staining material on the surface of the normal enamel matrix in the left second deciduous incisor. (×300.)

Fig. 16.—Left first deciduous molar showing similar changes. (×400.)

a predominating number of normoblasts. The bone marrow was rather cellular and showed all the characteristic cell elements.

C. *Dental Pathologic Findings.*—Both the maxilla and mandible were removed for study. Roentgenograms were taken of the jaws at the time of autopsy and histologic sections prepared.

1. *Gross and Roentgenologic Examination.*—No teeth were visible on gross examination, and the mucous membranes were of usual appearance.

On roentgenologic examination (Fig. 17), the follicles of the deciduous teeth and the mandibular first permanent molars were seen in their usual position. There was evidence of calcification in the mesial cusp region of the mandibular right first permanent molars.

2. *Histologic Examination.*—Changes were observed in all the deciduous teeth and the mesiobuccal cusp of the mandibular right first permanent molar. The lesions were more marked in the mandibular teeth and maxillary molars than in the maxillary incisors or canines. Since the changes were similar in all teeth, the findings in the mandibular right first permanent molar will be described as typical. Reference to other teeth will be made at various times for the purpose of clarifying certain of the findings.

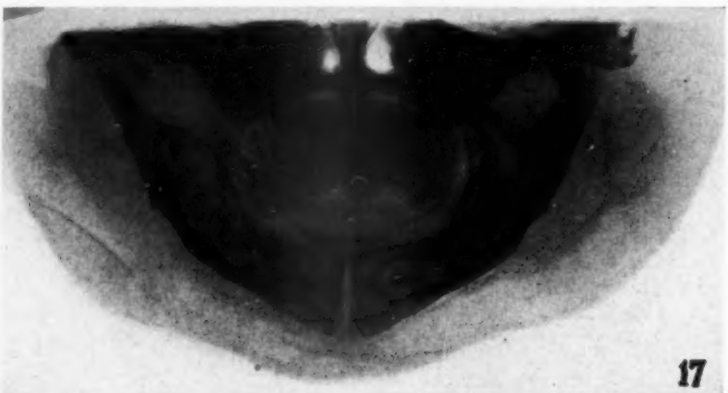


Fig. 17.—Roentgenogram showing the follicles of the deciduous teeth and first permanent molars in their usual position.

The ameloblasts of the mesiobuccal cusp of the right permanent molar (Fig. 18) are a regularly arranged, uniform layer of cells with their nuclei situated at the peripheral portion of each cell. The normal appearing stratum intermedium proximates their outer border. Their inner border is limited by a regular line which forms the boundary of the clear space to be described later. The enamel surface is irregular and has numerous flame shaped projections extending toward the ameloblastic layer. In the cusp crest region this irregular surface is separated from the underlying dark staining enamel by a narrow space. The remaining enamel structure has a radially arranged, rodlike architecture. The irregular enamel layer of the mesiobuccal cusp of the same tooth sectioned in a horizontal plane is seen clearly in Fig. 19.

A higher power magnification of the enclosed area in Fig. 18 permits a more detailed description of the histologic changes (Fig. 20). Some cystic change is observed in a few of the ameloblasts. Between the ameloblasts and the formed enamel is the clear space described by Orban[15] as the network of cementing

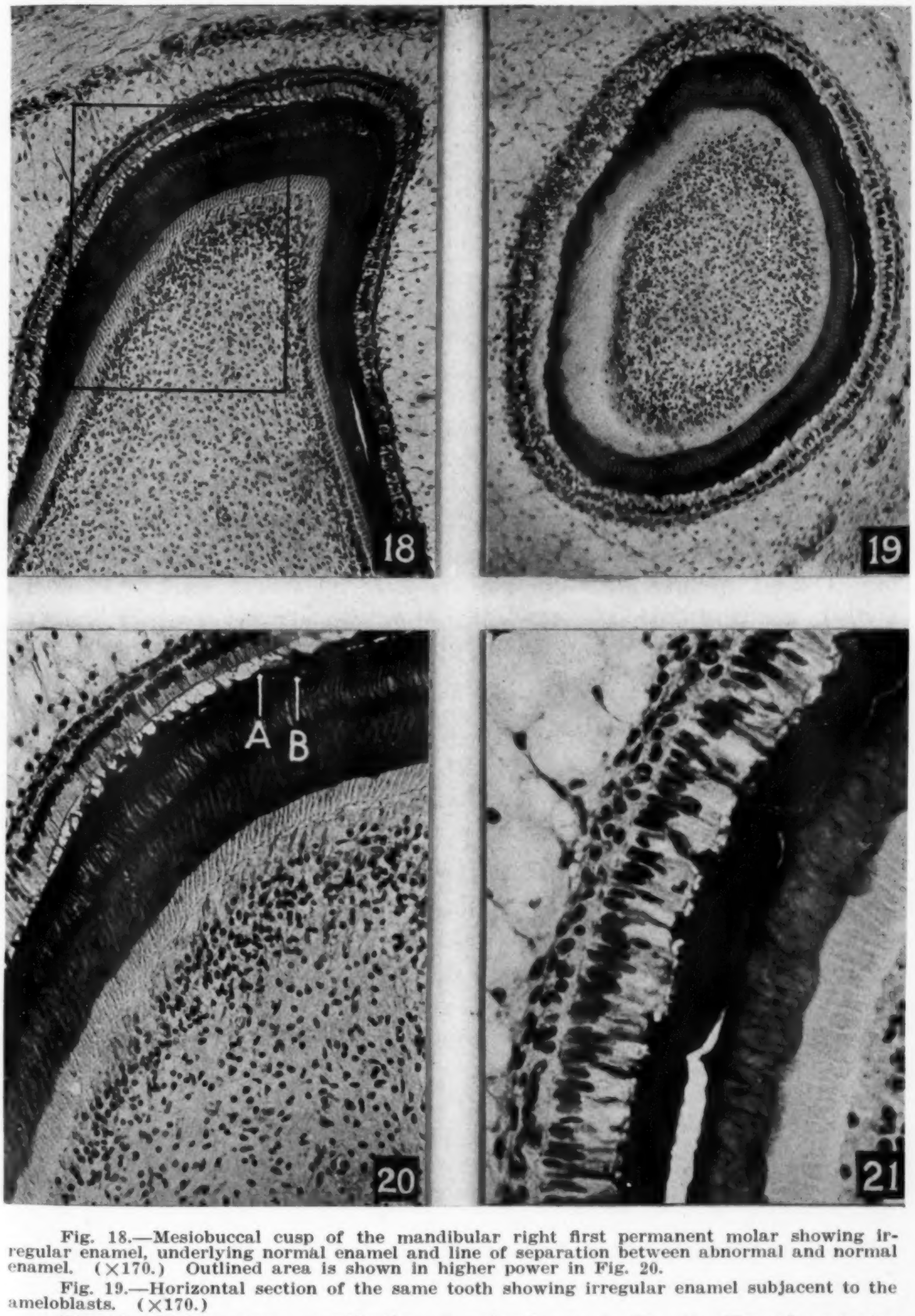


Fig. 18.—Mesiobuccal cusp of the mandibular right first permanent molar showing irregular enamel, underlying normal enamel and line of separation between abnormal and normal enamel. (×170.) Outlined area is shown in higher power in Fig. 20.

Fig. 19.—Horizontal section of the same tooth showing irregular enamel subjacent to the ameloblasts. (×170.)

Fig. 20.—Higher power magnification of enclosed area in Fig. 18. Normal appearing enamel *B* underlies the irregular enamel layer *A*. (×330.)

Fig. 21.—High power magnification of the mandibular right deciduous canine showing streaks of enamel-like material in the protoplasm of ameloblasts and vacuolization of some cells containing pyknotic and karyolytic nuclei. (×710.)

substance from which the Tomes' processes have been torn during histologic preparation. The irregular layer of enamel substance *A* is immediately adjacent but separated from the remaining enamel structure *B*. There is a wide spacing of the enamel rods in the area adjacent to the dentine.

The above changes are more clearly observed in the mandibular right canine (Fig. 21). The protoplasm of some of the ameloblasts contain included material. These streaks or globules are continuous with and stain similarly to the adjacent irregular enamel surface. There are marked morphologic changes in other cells. Some of the ameloblasts seen in Fig. 22 show large areas of cell vacuolization with crowding of the adjacent ameloblasts and nuclei. The nuclei in one region are pyknotic and centrally located. Other vacuolated cells contain malposed, light staining, karyolytic nuclei. The irregular surface of enamel is adjacent to the ameloblastic layer and separated from the underlying dark staining enamel.

The remaining structures of the enamel organ and the dentine and pulp tissues were of usual appearance.

The gingival tissues were intact. There were frequent epithelial invaginations into the underlying connective tissue. In the stratified squamous epithelium of the gingival tissues in the anterior region of the mandible was a large, round, cystlike structure. It was lined by a few layers of squamous epithelium and contained a mass of desquamated and necrotic epithelial tissue. A few epithelial pearls were present in the connective tissue.

The cortical bone was of the usual appearance. There was evidence of bone building, particularly on the inferior border of the mandible. The superior border of the bone presented a similar picture of active intramembranous bone formation. The alveolar bone surrounding the tooth follicles had numerous peripherally arranged multinucleated giant cells corresponding to areas of bone resorption. The bone marrow was not unusual.

Case 5

A. *Clinical History.*—A 3½-year-old male was admitted to the New Haven Hospital because of respiratory embarrassment and aggravation of his former symptoms and signs. The patient was a full-term baby and was essentially normal up to the age of 18 months when he developed a sore throat. At 25 months he contracted whooping cough. The present illness dates back to the onset of the cough which lasted about three weeks. Shortly afterward, it was noted that his face became swollen and the abdomen large and protuberant. The urine was found to contain large quantities of albumin. This condition continued the same for a month when the wrists and ankles became swollen. The child was then admitted to the hospital. His temperature was 38.6° C., pulse 104, respiration 22, and blood pressure 130/90. The red blood count was 3 million, hemoglobin 50 per cent and white blood count 9,000, with 10 per cent polymorphonuclear cells and 30 per cent lymphocytes. Blood studies showed an elevated nonprotein nitrogen and an inversion of the albumin-globulin ratio with a high cholesterol content.

The patient remained in the hospital for fourteen months during which time his condition remained the same. Nine days after discharge he was readmitted to the hospital because of increasing edema and ascites. The child's

condition went progressively downhill, and he died three days after admission.

The laboratory findings were: Nonprotein nitrogen 76 mg. per cent; total protein 3.77 per cent; albumin 0.51 per cent; and globulin 3.26 per cent. The specific gravity of the urine was 1.012-1.030 and showed casts, red and white blood cells, occasional cocci in chains and heavy traces of albumin.

The clinical diagnosis was chronic nephritis of nephrotic type, terminal uremia, and a question of aspiration pneumonia.

B. *General Pathologic Findings.*—Gross examination disclosed a large quantity of cloudy, gray fluid in the peritoneal cavity. The stomach and intestines were greatly distended. The only significant findings were in the kidneys and lungs. The kidneys showed many fine scarred areas and numerous petechial hemorrhages in the cortical tissues. Microscopic examination showed a marked increase in interstitial connective tissue and endothelial and epithelial proliferation of the glomeruli, many of which showed extensive fibrosis. There was marked atrophy of many of the tubules. The lungs showed some congestion and many of the alveoli contained a heavy fibrinopurulent exudate.

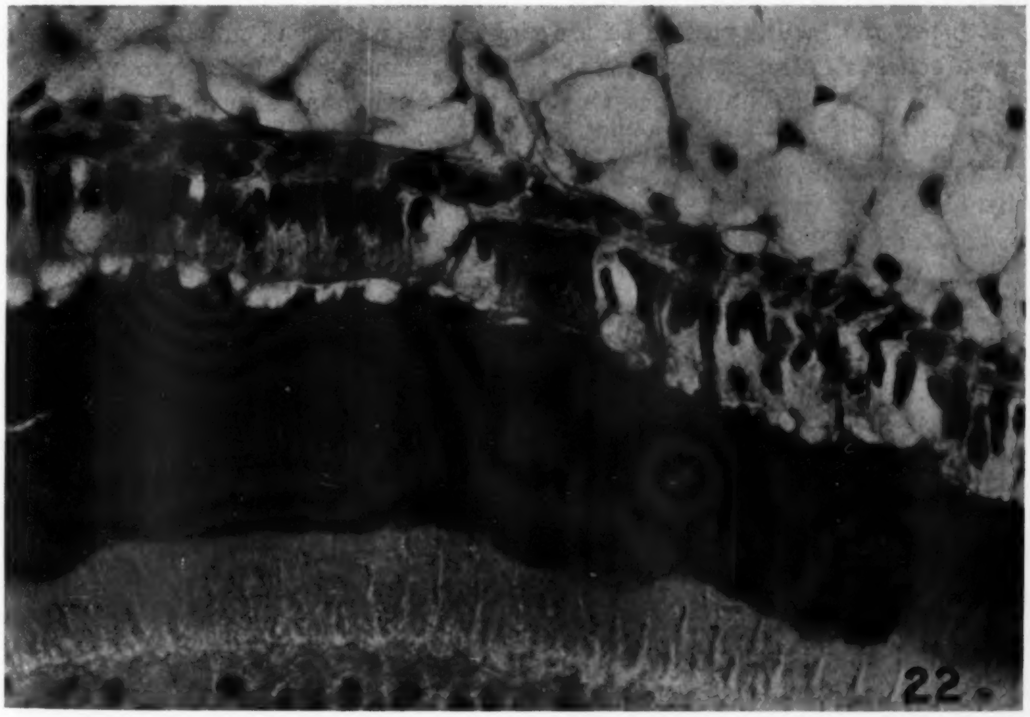


Fig. 22.—High power magnification of a region adjacent to that shown in Fig. 21. There is vacuolization of the ameloblasts and karyolysis and pyknosis of their nuclei, with crowding of the adjacent cells and nuclei to either side. (×475.)

C. *Dental Pathologic Findings.*—The entire mandible was removed at autopsy, and roentgenograms were taken. Histologic sections were prepared of that portion of the mandible including the deciduous and permanent central and lateral incisors, canines, and first deciduous molar on the right side; and the deciduous and permanent canines and second deciduous molar on the left side.

The remaining teeth, following celloidin embedding and decalcification, were preserved for examination by gross dissection.

1. *Gross Examination.*—The four deciduous incisors were the only teeth visible on gross examination. The deciduous canines and first molars could be felt beneath the gum ridge. The incisors were not unusual in appearance. The follicles of the permanent incisors were not suitable for gross examination. The left first deciduous molar and first permanent molar were seen in their crypts. On dissection, the enamel of these teeth showed no gross defects. The underlying dentine was light gray-pink in color and was everywhere slightly thicker than the correspondingly located pink enamel structure. The enamel was felt to be much softer in consistency than the dentine. The pulpal tissues were a light yellow color and fuzzy in appearance. No gross defects were observed in these teeth or in the right second deciduous and first permanent molars.

2. *Roentgenologic Examination.*—On roentgenologic examination (Fig. 23) the erupted deciduous incisors and unerupted deciduous canines and molars were visible in their usual position, as were the follicles of the permanent incisors, canines, and first permanent molars. All the teeth showed evidence of calcification.

3. *Histologic Examination.*—Definite changes were observed in all the permanent teeth. The deciduous teeth were not unusual. On the lingual surface just below the incisal portion of the right first and second permanent incisors was a concave defect in the enamel. The adjacent ameloblasts were no longer visible as a regularly arranged single layer of columnar cells. Occupying the entire space of the defect in both teeth was an edematous-like material containing numerous pyknotic nuclei. These lesions were less marked than similar changes observed in other of the teeth studied. These will be described later in greater detail.

In the cervical region of the labial surface of the right first permanent incisor, at the termination of the enamel matrix, is a large cystlike area (Fig. 24) involving the ameloblastic layer, stratum intermedium, and stellate reticulum. The walls of the cyst are formed by flattened and elongated ameloblasts. That portion of the cyst proximating the formed dentine is seen to project somewhat into the dentinal structure, producing a corresponding concavity. The stellate reticulum, to the right, is nearly obliterated by the mass. The ameloblasts forming the upper and lower borders of the cyst are crowded and flattened in appearance, and the cells comprising the stratum intermedium terminate abruptly at these points. The outer enamel epithelium is uninvolved. Filling the cyst cavity are numerous flattened, karyolytic nuclei and concentrically arranged light purple staining fibers.

Defects in the enamel structure, corresponding in location to those observed in the right central and lateral incisors, are seen to a marked degree in both permanent canines. The broad V-shaped notch in the enamel surface of the right canine (Fig. 25) is filled with an edematous material in which numerous pyknotic nuclei are scattered about. Forming the outer border of this mass is the reduced stratum intermedium and outer enamel epithelium. At the incisal margin of the defect and at its cervical termination, not seen in the photomicrograph, is a gradual transition to regularly formed, normal appearing ameloblasts. These are seen everywhere to overlie normal enamel matrix. A

higher magnification (Fig. 26) permits a more detailed study of the defective area. Filling the concavity is an edematous mass of cells, many of which are vacuolated. Small, round, dark staining nuclei are scattered about. The low

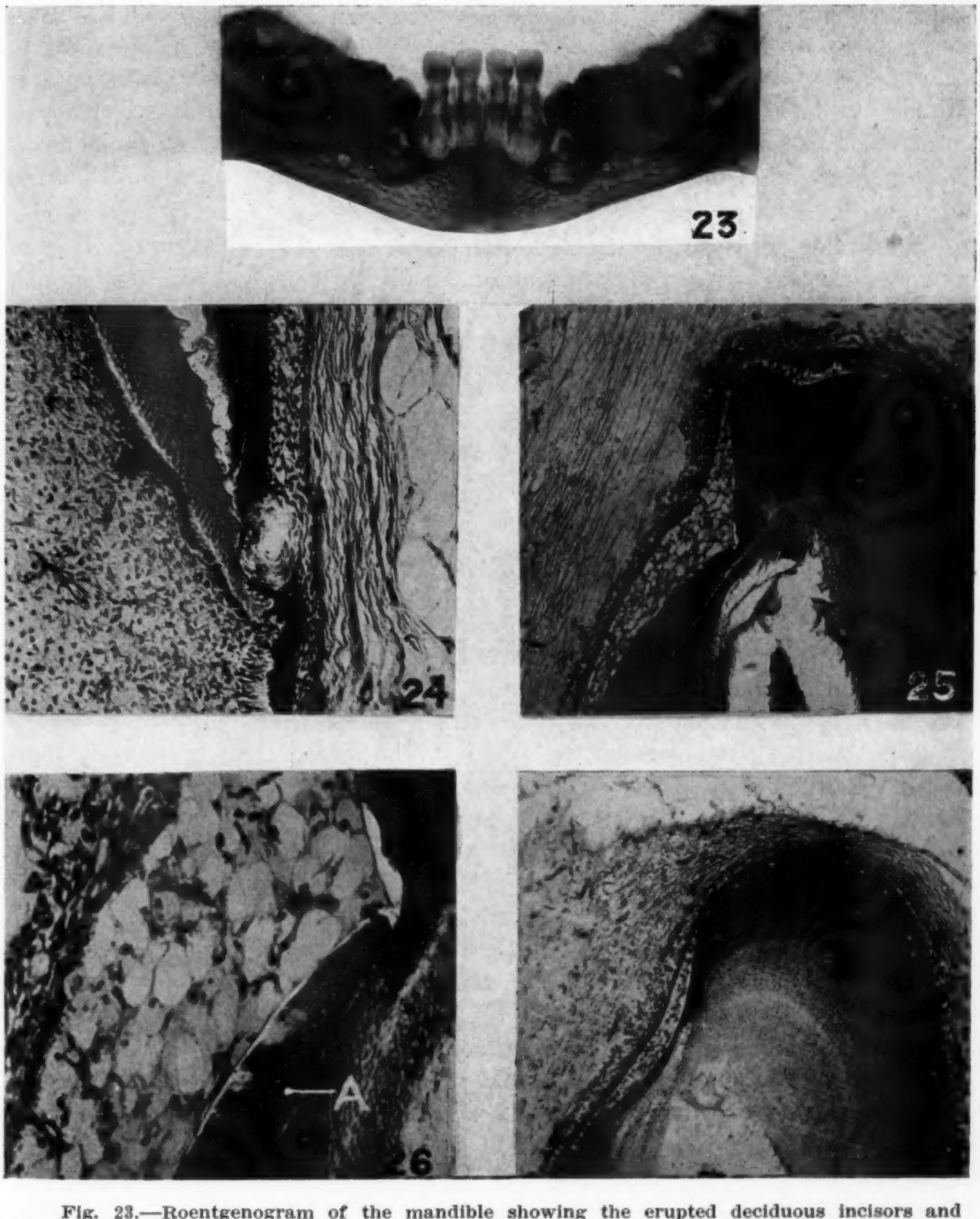


Fig. 23.—Roentgenogram of the mandible showing the erupted deciduous incisors and unerupted deciduous canines and molars. The follicles of the permanent incisors, canines, and first molars are seen in their usual position. All the teeth show evidence of calcification.

Fig. 24.—Cervical region of the mandibular right first permanent incisor showing a cyst-like structure involving the ameloblasts and encroaching upon the dentine and stellate reticulum. (×125.)

Fig. 25.—Notchlike hypoplastic defect in the enamel structure of the right permanent canine. (×65.)

Fig. 26.—A high power magnification of the hypoplastic area in the previous illustration showing the markedly vacuolated and endematous appearance of the material filling the space of the defect. Pyknotic nuclei are scattered haphazardly about. At *A*, is a wide incremental zone in the formed enamel matrix. (×250.)

Fig. 27.—A similar hypoplastic defect in the incisal region of the left permanent canine. (×65.)

cuboidal cells, comprising the stratum intermedium subjacent to the outer enamel epithelium, are not unusual in appearance. The surface layer of enamel matrix immediately underlying the hypoplastic area is without definite architecture and is irregular in its staining qualities. Subjacent, is seen a narrow zone of enamel in which the enamel rods course at a markedly oblique angle to the surface. Below at *A* is a layer of enamel in which distinct striations or incremental lines are seen to parallel the outer enamel surface. This structure is interrupted for a short distance at the deepest portion of the hypoplastic area. Normal appearing enamel matrix proximates the above-described edematous mass at this point. An abrupt termination of the enamel rods at the line of transition from normal enamel to the striated layer is seen.

A similar defect is present in the left permanent canine (Fig. 27).

Dentine and pulpal tissues were of usual appearance in all the teeth studied.

DISCUSSION

Definite changes were observed in the developing deciduous and permanent teeth. The writer believes that the material presented permits a sequence to be traced from the earliest stages of abnormal enamel formation to the end result of clinical hypoplasia.

The abnormal formation or secretion of enamel substance, seen in the first four cases, probably represents a manifestation of injured ameloblasts. In many regions this irregular enamel lies subjacent to normal appearing cells (Fig. 11). It is conceivable that ameloblasts, like other tissues, may be injured to varying degrees. A slight injury may then result in a temporary disturbance of function without complete destruction of the cells, as seen in the prominent incremental lines demonstrated by Schour and Smith[10] in experimental fluorosis. This possibility was suggested by Black,[16] who stated that "deformity in all cases consists of an arrest or partial arrest of growth of both enamel and dentine in the particular zone being developed at the particular time. In the milder cases growth is imperfect, leaving certain definite markings outlining the particular parts of the tissue then being formed. In all the severe cases, the growth of both enamel and dentine is arrested. There seems to be no recovery of the part of the enamel organ that was at that time in active formation." It may be assumed, therefore, that this change represents a mild injury and some of the ameloblasts have already regained their normal function. It is further recognized that a disturbance in function may not always be demonstrated morphologically. Possibly representing this stage at the moment of active response to injury, or else a slightly more severe disturbance to the ameloblasts, is the presence of enamel-like material in the cytoplasm of otherwise normal appearing cells (Fig. 6). This would not alone be of significance if we are to accept Williams'[13] explanation of enamel formation as a deposition of droplets or spherules of calcoglobulin by normally functioning enamel epithelial cells. An associated abnormal enamel formation would, however, be evidence of some disturbance in amelogenesis. It is likely that this change is still reversible, the cells retaining an ability to return to normal function. Whether this initial stage is of such a degree as to progress to a final clinical hypoplasia, is a matter of conjecture.

Indicative of more severe injury to ameloblasts is the beginning of cystic change. From the photomicrographs it appears that this first occurs in the peripheral portion of the cell, gradually progressing inferiorly to involve the entire ameloblast or group of ameloblasts. Streaks of enamel-like material projecting inferiorly from such vacuolated areas seem to indicate either an initial hypersecretion or a complete destruction of cells with loss of their contained enamel substance. That the irregular enamel layer subjacent to the ameloblastic layer is a manifestation or result of cell injury is evidenced by its junction with the cellular projections or secretions (Fig. 5). The final stage of cell injury may be represented by completely cystic areas.

In the photomicrographs of the first four cases it is seen that the abnormal enamel structure is present over a large portion of the developing crowns of the teeth. The outer border of the underlying normal appearing enamel is uniform and sharply demarcated from the irregular, abnormal layer. These observations appear indicative of injury to a large number of enamel forming cells which would result in an abrupt transition from normal to abnormal enamel.

A result of complete cell destruction with loss of function is represented in the last case. Due to the varying degrees of cell injury, some ameloblasts may retain their ability to function and others, more severely injured, may lose all power to operate in amelogenesis. The areas of hypoplasia would be evidence of the latter. The ameloblasts overlying the notch-like defect are completely destroyed and an edematous mass of vacuolated cells is present (Figs. 25 and 26). The cells bordering this defect are of normal appearance and consequently are able to maintain their function. Of interest is the broad incremental zone at *A* in the same figures, demonstrating a previous period of slight cell injury before the ameloblasts lost all ability to function.

From a survey of the literature, it is seen that many theories have been advanced regarding the mechanism of hypoplastic formation. In the light of recent studies by Diamond and Weinmann[9] on normal enamel formation, i.e.; that enamel formation is a primary function of the ameloblasts and calcification a secondary process occurring after the complete formation of the organic enamel matrix, it may be assumed that the primary injury or disturbance, during the developmental period, is to the ameloblasts and not to the formed enamel as stated by Gottlieb.[6] The abnormal enamel formation is merely a manifestation or result of this disturbance.

The disturbances here described cannot be definitely attributed to any particular disease process during life. In the first three cases no pathologic changes of significance were found at the time of autopsy. It was first considered that the dental changes might have been those associated with the formation of the neonatal line. Since these infants were stillborns, it is doubtful whether the disturbance at birth could have been related to the dental changes or have had sufficient time to cause them. Kronfeld and Schour[17] reported that the neonatal arrest in enamel formation is ten to fourteen days in duration, thus including that important period of environmental adjustment following birth. Schour[18] observed no changes in the teeth of two full-term fetuses. In the six cases comprising the so-called control group of the present study, no unusual changes

were found. The first of these has already been described briefly. With the exception of one six-month premature fetus, the remaining cases were full-term stillborns.

In Case 4 of the presented series, both the clinical and autopsy findings confirm a diagnosis of erythroblastosis. Whether this is directly or indirectly related to the dental changes is conjectural. Since the infant lived fifty-seven hours, it is possible that the lesions may have occurred postnatally and been directly related to the generalized disease process. An attempt was made to determine this time relationship by measuring the thickness of the abnormal layer of enamel. On the basis of Schour's and Poncher's[22] calculation of four micra of enamel formation per twenty-four hours, the 8.4 micra thickness of the abnormal layer seemed to indicate that the disturbance occurred during the last fifty-two hours of life and consequently was postnatal. It is considered, however, that due to the abnormal amelogenesis, the rate of enamel apposition may well have been altered.

The marked hypoplastic defects and ameloblastic injury observed in the last case may conceivably be associated with the severe systemic disturbance diagnosed both clinically and at autopsy. The onset of the illness at approximately two years of age, which coincides with the period of enamel formation of the hypoplastic permanent teeth, makes this likely. As further evidence is the absence of any lesions in the deciduous teeth. Since the enamel of these teeth is completely formed at two years of age, a disturbance after this period could have no effect on amelogenesis. The incompleted root formation of the deciduous canines and molars and the retarded development of the premolars and second permanent molars are additional evidence of some disturbance.

It is generally accepted that various disturbances such as syphilis,[19, 20] dietary deficiencies[11, 12] and fluorosis[10] may disturb the normal process of tooth development with resulting hypoplastic defects. That other disturbances may be associated with structural dental defects was suggested by Black,[16] but no conclusive evidence is as yet available to support this view. From the material presented it appears that abnormal enamel formation is a nonspecific manifestation of a variety of disturbances, any of which, dependent upon severity and the degree of cell injury, may result in hypoplastic defects.

SUMMARY

Histologic studies were made of the developing teeth of eleven infants and human fetuses. Definite changes were observed in the ameloblasts and organic enamel matrix of the deciduous and permanent teeth in five of the cases. From the material presented, the writer believes it possible to trace the histogenesis of enamel hypoplasia from its earliest manifestations to the end result of clinically demonstrable defects.

The earliest changes are marked by an abnormal formation or secretion of enamel substance subjacent to and within the cell cytoplasm. There is little or no further evidence of ameloblastic change. It is likely that this stage is reversible, the cells retaining an ability to return to normal function. A prominent incremental line would be the only subsequent indication of such temporary dysfunction.

A later and more severe stage is recognized by the beginning of cystic change in the ameloblasts. Vacuolization begins first in the portion of the cell proximating the stratum intermedium and gradually progresses inferiorly to involve a larger part of the cell structure. Streaks and globules of enamel-like material project inferiorly from such injured cells and are continuous with the abnormal enamel layer.

Complete cystic destruction of ameloblasts marks the final stage in the pathogenesis of enamel defects. Such cells can no longer function in amelogenesis and clinical hypoplasia results.

It is apparent that abnormal enamel formation is nonspecific in nature and cannot, in the presented material, be definitely associated with a particular disease process or injury. That a variety of disturbances may be the causative agent in such abnormalities is accepted. Any of these, dependent upon their severity and the degree of tissue response, may result in the so-called hypoplastic enamel defects.

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Case Reports

The following case is one presented by Dr. Losch and Dr. Weisberger from the Harvard Dental School.

Case reports for this section of the Journal should be sent to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

CASE REPORT NO. 44

HIGH CARIES SUSCEPTIBILITY IN DIMINISHED SALIVATION

P. K. Losch, D.D.S., and D. Weisberger, D.M.D., M.D., Boston, Mass.

THIS patient appeared at the Special Children's Clinic in the fall of 1932 at the age of 4 years, with all deciduous teeth except the maxillary second molars cariously exposed and abscessed. Further oral examination revealed a dry, stippled mucosa throughout the mouth, and it was noted that little if any secretion was available by Stenson's duct. The diet was adequate at this time but required mixing with fluids (milk or water) to permit swallowing.

Fig. 1.

The past history revealed nothing significant except that the child had been placed in the grandmother's care at birth and had been bottle-fed until the third birthday. Solid foods in any form had not been introduced until after the second birthday. The bottle-feeding had been whole unpasteurized milk from

the beginning. In consultation with the Children's Hospital Outpatient Department it was decided that complete extraction was indicated. The hospital gave a negative report on any systemic illness and reported her well nourished.

The early loss of deciduous teeth precipitated the erratic eruption of the adult incisors at age 5. By age 10½ years all premolars and first molars as well as the mandibular canines were in functional service.

All of the adult teeth were seriously involved with smooth surface caries before they were in service one year. Although every effort was made to encourage good home care, the mouth seemed always in a wretched state of hygiene (Fig. 1). The lips and mucosa were constantly dry. There was a tendency for materia alba to collect at the corners of the mouth.

At intervals of four months it was frequently necessary to replace fillings because of secondary lesions occurring at the margins of the filling. By age 11 it was necessary to root fill the mandibular incisors.

Fig. 2.

It was noticed that the eyes were constantly "tearful" though the patient was always well behaved and cheerful.

Physical Examination.—The child was a well-developed and nourished white female of 12 years. The physical examination revealed no abnormalities, except the xerostomia and caries and apparent absence of tear ducts. There was no

evidence of a generalized ectodermal dysplasia; the hair, skin, eyes, and nails were normal. There were no signs of vitamin deficiency such as may be seen in lack of vitamin A. Roentgenographic examination revealed absence of salivary calculi in gland and ducts.

Laboratory Findings.—The red blood count was 4,500,000; white blood count, 7,800; hemoglobin, 90 per cent Sahli; differential, normal. The urine showed a specific gravity of 1.018, reaction acid, albumin, 0, sugar, 0. The blood chemistry was as follows:

Plasma Vit. C	1.5 mg. per cent
Blood Vit. A	2.6 mg. per cent
Blood sugar	82.0 mg. per cent
Blood calcium	9.8 mg. per cent
Blood inorganic phosphorus	3.7 mg. per cent
Phosphatase	3 Bodansky units

A special salivary test showed the salivary volume after stimulation by chewing paraffin wax, 1 c.c. in one hour (Fig. 2).

Impression.—Hypofunction of salivary glands, etiology unknown; agenesis of tear ducts; dental caries.

DISCUSSION

This case seems to be a definite clinical example of the effects from lack of salivary secretion. Some correlation between dental caries and diminished salivary secretion has been demonstrated clinically and experimentally.[1, 2]

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Growth and Development of the Dental Arches in Children: By Joseph T. Cohen, D.D.S., Minneapolis, Minn., *J. A. D. A.* **27**: 1250, 1940.

In order to determine the changes in the dental arches incident to growth and development, a longitudinal study was made on a large group of children, of which twenty-eight were selected for this report, covering a period of eleven years. Study casts were made annually and were measured, some of the measurements being predicated on the fairly well-established assumption that the position of the teeth and the rate of their growth have an influence on the growth and development of the arch.

The growth curves of the boys and of the girls, from canine to canine (3-3) and from deciduous molar to deciduous molar (4-4) appear to follow about the same pattern, with a consistently larger arch development for the boys than for the girls. There appears to be some little growth between the second deciduous molars (5-5) on both sides of the arch and between the first deciduous molars on each side of the arch, and there is a quite definite growth in the canine area of the upper arch. This growth spurt occurs in both boys and girls at from about 6 to 8 years of age, which corresponds approximately with the time of eruption of the maxillary incisors. These findings agree in general with those of Lewis except that according to his findings there was a complete cessation of growth between 9 and 10½ years, while Cohen's findings showed continued growth, but in a lesser degree, up to the twelfth year.

Between the mesial side of the canine and the distal side of the second deciduous molar, there appears to be no growth, and it might be said that the space is shorter at 13½ years than it is at 3½ years of age.

The mandible in the molar region is considerably wider in girls than in boys. It was noted that the size of the upper arch of girls was slightly larger than that of boys, but, in the lower arch, there is a more distinct difference. The remaining measurements of the arches of the boys and the girls are about the same, with the exception that the boys' arches again are wider in the canine area than those of the girls.

There seems to be little lateral growth in the molar region and in the region of the second deciduous molar. A little growth appears between the ages of about 6 and 10, in the first deciduous molar region, but a consistent and definite growth period appears in the canine region between the ages of 5½ and 8½, or during the period in which the mandibular permanent teeth

are erupting. After the nine-year period, there seems to be no lateral growth in the canine area in either the girls or the boys. Until the age of $10\frac{1}{2}$, the curve closely follows the findings of Lewis, but, from then on, Lewis' subjects developed another spurt in growth, while Cohen's showed no further lateral development in the canine area. The difference between the mesial side of the canine and the distal side of the second deciduous molar in the lower arch consistently becomes smaller, the size at $13\frac{1}{2}$ years being about 2 mm. narrower than at $8\frac{1}{2}$ years of age. This is according to what one would expect, since the permanent premolars which replace the second mandibular deciduous molars are considerably smaller, and there is a mesial shift of the first permanent molar and perhaps a distal shift of the anterior teeth to close up this space.

The girls' arches are narrower in the anterior portion of the arch or in the canine region than the boys', but the girls' arches are wider in the posterior, or first permanent molar, region. Thus, the boy's arch is more rounded; the girl's more v-shaped.

Mean growth curves may frequently be helpful in determining what a normal arch should be, and, in many instances, they might be of considerable practical value. However, there are frequent occasions in which arches develop normally along diverse patterns, and it would be foolhardy to attempt to fit these cases to the mean pattern of growth as developed for any particular group of children. In other words, these mean curves indicate a tendency: they do not determine individual variations from the norm.

The greatest lateral growth in the dental arch occurs in the canine area during the eruption of the permanent incisor teeth. The distance between the mandibular canines reaches its maximum at eight and one-half years, and from then on there is little growth. Acceleration of growth between the maxillary canines is greatest at from 5 to 8 years, a slow steady growth continuing until the age of about 12 years. In the period studied, there is little lateral growth of the arches between the first permanent molars and only a slight growth of the arches between the premolars.

The distance from the mesial side of the maxillary canine to the distal side of the second premolar on the same side becomes somewhat less in the upper arch. In the lower arch, there is a definite decrease in this dimension.

The dental arches of girls, and particularly the lower arches, are wider in the posterior section than those of the boys, but narrower in the anterior section.

Graphs made of different individuals indicate that there is a wide variation in development of the dental arches, and that individual children often depart from the pattern described.

Retruded Chins: Correction by Plastic Operation: By Gordon B. New, M.D., and John B. Erich, M.D., Rochester, Minn., *J. A. M. A.* **115**: 186, 1940.

Retrusion of the mandible and of the chin, no matter how slight, can disturb both the function of the jaws and the symmetry of facial contour. Treatment of retrusion of the mandible must, therefore, consider function and esthetics. This article concerns itself with surgical methods of overcoming cosmetic defects. The authors feel that orthodontics and oral surgery are, as

a rule, indispensable in these cases. They point out that the choice of procedure in the correction of mandibular retrusion is dependent on many factors but primarily on the cause and extent of the deformity and on the age, financial status, and personal wishes of the patient.

With regard to the shortcomings of surgical procedure when used alone, New and Erich state the following:

> "From an esthetic point of view, one conspicuous fault in some technical procedures designed to correct the external deformity resulting from a retruded chin is the failure of these operations to establish normal dental occlusion. Although we do not wish to engage in a discussion of the dental aspects of the subject, the fact that no other facial deformity is more intimately related to the occlusion of the teeth is worthy of emphasis.
>
> "It is well to remember that a significant association exists between dental articulation and facial contour. Embryologic and anatomic studies have shown that the development, eruption, and ultimate position of the teeth in the dental arches determine the shape or form of the maxillary bones and, in turn, the conformation of the overlying soft tissues. It is evident, therefore, that the manner in which the dental cusps interlock is reflected in the features of every individual; even minor disturbances of occlusion will produce some degree of facial asymmetry or disharmony. In short, no face is perfect in contour unless the teeth are faultless in occlusion.
>
> "Very few patients with a retruded chin, regardless of the cause of the deformity, are free from malocclusion; as a matter of fact, the disturbed occlusion is usually most conspicuous. Consequently, one may rightly assume that plastic procedures capable of effecting entirely satisfactory esthetic results not only must produce a natural contour of the chin but also must establish normal articulation of the teeth; at least, such operations must create a semblance to normal dental occlusion."

Reference is made to the psychologic value of correcting facial deformities. Orthodontists are well acquainted with the change in mental attitude and personality of children and adults who have experienced correction of facial disbalance. From a psychologic standpoint, this fact has as yet not received due emphasis by orthodontists.

It is surprising to find that New and Erich, of the section of laryngology, oral and plastic surgery of the Mayo Clinic, still subscribe to the now generally discredited theory that ". . . the contour of the mandible is largely controlled by the growth, eruption, and position of the teeth in the dental arches." These authors state further: "As each tooth erupts, the jaw progresses another step in development by expanding and changing in form to meet the physiologic requirement of support for the tooth when at rest and when subjected to the stresses of mastication." We need only point to the fact that well-formed mandibles, as far as facial contour is concerned, are usually found in children with partial, and even with complete anodontia. This should not be confused with the existence in these cases of alveolar deficiency, and a shortening of the

interalveolar distance which manifests itself in the characteristic facial appearance of these patients.

While the forward growth of the jaw does, indeed, take place concomitant with the eruption of the permanent molars, as was first noted by Hunter (1771), it is muscular function and collateral blood circulation which are mainly responsible for mandibular growth in the absence of congenital or environmental interferences of endocrine, nutritional, and of genetic origin.

There is, of course, no question that "Any agent which interferes with the normal forces of tooth eruption marks the beginning of a malocclusion," it does not follow, however, as stated by the authors, that this ". . . provokes an abnormal mandibular contour which is accentuated by the subsequent development of the lower jaw." The presence of malocclusion does not in itself presage disturbances in development of the contour of the mandible per se. Nor, for that matter do disturbances in mandibular contour always entail malocclusion of the teeth.

We cannot agree with New and Erich when they state that

> "Since the etiologic factors which produce mandibular retrusion occur during the growing period of the individual when the jaws are undergoing a series of changes in development, the primary deformity can be expected to become gradually more pronounced. In most instances, then, a retruded chin or mandible is not a static deformity, which, when once established, remains unchanged; on the contrary, it is one of progressive severity. Not until the physiologic processes of development of teeth and bone have been completed does such a deformity reach its final proportions."

To begin with, as already pointed out, the etiologic factors may be of genetic differentiative, congenital or postnatal, metabolic or functional origin. Regarding the deformity becoming more pronounced, this is true only in relation to the increased growth of the maxilla and the rest of the face and the cranium. It is not a question of the mandible itself and chin becoming smaller, unless the mandible is attacked by some bone disturbance which involves destruction of the mandible.

The following plans of treatment are listed as having been recommended in cases of retruded mandibles and chins:

1. Various types of osteotomy through the horizontal or ascending rami to lengthen or advance the mandible.
2. Osteotomy through the horizontal rami associated with the use of bone grafts to lengthen the mandible.
3. Cartilage implants inserted behind the head of the condyles for advancement of the mandible.
4. Cartilage, bone, ivory, and celluloid implants for building up the chin to normal contour.
5. Prosthetic appliances requiring the use of intraoral skin grafts for restoration of normal chin contour.
6. Orthodontic methods.

Because they feel that a retruded chin or mandible is a deformity of progressive severity during the developmental period of the jaws, the authors advocate early and immediate treatment as the most important consideration. From an orthodontic viewpoint, early surgical treatment of mandibular retrusion would seem to be indicated in extreme cases only. Since mandibular retrusion does not of itself necessarily affect the growth of the maxilla, it is likely that continued growth of it and the rest of the face may entail repetition of the operation at a later date when the child is older.

Although orthodontists will agree that "The majority of retruded mandibles essentially due to malocclusion can be entirely corrected by orthodontics if the disturbed dental articulation is observed early in the life of the patient," they will hardly subscribe to the statement that ". . . it is best if orthodontic measures can be set in operation before the permanent teeth erupt." The foregoing may be true as far as extreme cases are concerned and as it relates to the removal of manifest local interferences of jaw growth, but can hardly be accepted as a general rule.

The contention of the authors that "Retruding mandibles resulting primarily from an arrested bony growth are seldom rectified by orthodontic methods alone," is well founded when considered in the light of present orthodontic knowledge and experience.

Editorials

Dentistry to Mobilize

Modern war, or preparation for defense, is not restricted to armed forces, and in this new era the capacity to organize and to produce the entirely new weapons of war is highly important. To be ready in all departments "behind the lines" is the watchword now. No one is exempt from a part in this great movement, and no one can escape the effects and major dislocations even in the professions that are eminent.

During this period now in progress dentistry and medicine, obviously, are destined to work in close collaboration and to take a more conspicuous part than heretofore at any time in the history of defense preparation. Dentistry is becoming increasingly important as a physical improvement agency.

For instance, during June, July, and August of this year 23 per cent of the applicants for enlistment for the army were rejected on account of defective teeth, and it has been noted that 90 to 95 per cent of all applicants have defective teeth. Dentists will supply dentures and restorations of all kinds to drafted men and will work in complete harmony and accord with the medical profession in the repair of injuries which may be helped by their mechanical dexterity and skill.

As evidence of the care and precision now manifest, and as a criterion of how the Surgeon General's office and the American Dental Association are in full cooperation, the A. D. A. has sent a questionnaire to practically every dentist throughout the country. The questionnaire outlined important questions to be answered by the individual dentist in order that the A. D. A. may be fully equipped to cooperate with the war department during mobilization. The response of the dental profession has been prompt and reflects a highly cooperative spirit on the part of the profession as a whole. This, no doubt, is encouraging to those in the war department who are in a position to allocate dental service in places where it will do the most good during these extraordinary times.

As a contrast to this satisfactory preliminary preparation pertaining to dental service for the armed forces at this time, it may be recalled that at about the time of the beginning of the first World War there were less than a hundred officers in the dental corps of the army. If one compares this with the present plans, which, according to Brigadier General Fairbank, call for the mobilization (for training) of 15,000 dentists during the next five years, one will get some conception of the important place which modern dentistry holds in the welfare of the armed forces of the United States of America. This regimentation of dentists can and will be a great aid to medical service in all hospitals wherever located.

Every dentist in America should read the article entitled, "Dentistry and National Defense," by Brigadier General Leigh C. Fairbank of the Surgeon General's office in this issue of the AMERICAN JOURNAL OF ORTHODONTICS AND

Oral Surgery and thereby learn firsthand what is ahead for dentistry in mobilization plans. Every young dentist, particularly, should carefully read this address in order that he may better understand what his position as a dentist may be in the draft now in operation, and in order that he may better know what is ahead in the comprehensive plans pertaining to making the services of modern scientific dentistry available in this national emergency.

H. C. P.

Orthodontics in Retrospect

Five thousand years of history bear witness to the fact that truth will prevail in the end and that good always triumphs over evil in the final score, because God is still supreme and the sun rises after the darkness. In these troublesome times it is easy to forget how old the world is and how many times the same scene has occurred in the past, only piloted by other leaders who have long since gone to their reward. Even though this has all happened to other generations, and there have been serious times of war and famine, yet each in turn has lived to see a brighter day and joy has arrived with the morning dawn.

In order to divert the mind from the present world chaos, it is interesting to thumb through some orthodontic literature of another day to see how men were thinking at that time as compared to how you are thinking about your orthodontic problems of today.

It was interesting, for instance, for a change and diversion from the tempo of the times to go back for an interval to the pre-radio—pre-automobile—period and muse through the third revised and enlarged edition of *The Angle System Regulation and Retention of the Teeth,* published in 1892 by the Wilmington Dental Manufacturing Company. Here it is both interesting and revealing to note the thought of the leading authority on the subject of that time. For instance, in his discussion of Class II, Division 1 it is noted, "difficult cases known as excessive protrusion of the incisors and cuspids," he describes the procedure as follows—"The wire arch is bent exactly to the form that we wish the teeth to be arranged when the operation is completed. The ends of the arch are now slipped through the pipes in the molars. The anterior part of the arch is kept from sliding up and impinging upon the gums by resting in suitable niches formed in the delicate bands encircling and cemented to the centrals or lateral incisors." To excerpt a little farther on—"The power to be exerted in moving backward these teeth is derived from heavy elastic bands attached to a cap covering the back part of the head, thus gaining occipital anchorage instead of depending upon the anchorage of the molar teeth which is never enough in these cases to withstand the great strain necessary to force backward the protruding teeth but are always when so relied upon tipped forward more or less and faulty occlusion established. The occipital anchorage prevents this annoyance. A traction bar is used for conveying the force from the occipital bandage and distributing it to the wire arch." To excerpt from this description a little farther on—"The ends of the traction bar may therefore be moved in any direction without interfering with the pressure from the bandage. The advantage of this attachment is that in consequence of the freedom of motion any jar or shock upon the traction bar will not be transmitted to the tender teeth. As the

bandage and bar are to be worn only at night, shocks from contact with the pillow would be very liable to occur and occasion pain were it not that the bar is provided with this freedom of movement. The usual method is to attach the traction bar or its equivalent to a swaged or vulcanite cap covering and firmly resting against all the teeth to be moved."

"As the heavy rubber ligatures of the bandage act during the night only, provision must be made to hold through the day what is gained at night. This if effectually accomplished by delicate rubber ligatures which are slipped over the distal ends of the pipes on the molars stretched forward and tied with silk ligatures in front of the small collars which encircle the wire arch opposite the cuspids." Then he goes on to describe the method of making the occipital cap in order to distribute the pressure equally over all parts of the head.

It is interesting now to jump ahead to the year 1940 and thumb through the excellent pamphlet, ***Facts About Orthodontics for Health Workers,*** published by the Public Relations Bureau of the American Association of Orthodontists and note the difference of viewpoint expressed as contrasted with the Angle book which antedates the pamphlet by nearly one-half a century. It is quickly noted in the latter pamphlet the theme running entirely through the various answers to the questions asked is the phenomenon of growth, and it is to be remembered as well this latter pamphlet is written for the laymen. Here is ample evidence that in fifty years the orthodontic thinking has changed right about face from "pressure" to growth mindedness, and very delicate pressure now regarded only as a means to encourage or "direct the traffic" of growth. The last and final question asked in the public relations committee booklet is, "Is this all there is to straightening crooked teeth?" And the answer follows—"Orthodontics concerns itself with growth. Teeth are not just forced or pried into or out of position by the exertion of mechanical pressure. If this were true one could easily make an apparatus at home and apply it to the teeth to push them in the desired direction. On the contrary, orthodontics is a highly specialized division of dentistry which requires specific knowledge of fundamental sciences, which alone makes it possible to apply corrective treatment.

Reading orthodontic history of yesteryear is not only interesting diversion for the present hectic era, but it will serve to make you conscious and appreciative of what has actually happened orthodontically in one generation of practice, also it will cause you to wonder what is to take place in the next fifty years. You may be even inclined to doff your hat in respect and admiration for that band of intrepid stalwarts who have unselfishly worked and searched for orthodontic truth and expediency of treatment, and for simpler ways and methods of solving the orthodontic problem for childhood. Fortunately, such effort reflects astounding progress and to better appreciate your specialty and its marked advance in such a few years it is recommended that you read any orthodontic text published one-half century ago. In this you will find not only interest, revelation and diversion, but you will ask yourself what other department of either medicine or dentistry has made such spectacular progress within a period of fifty years on individual practice and resource alone and your answer will, no doubt, be *none.*

H. C. P.

News and Notes

New York Society of Orthodontists

The following is a synopsis of the Fall Meeting of the New York Society of Orthodontists which will be held on Monday and Tuesday, Nov. 11 and 12, 1940, at the Waldorf-Astoria Hotel in New York City.

Monday Morning:

Case Report. Charles W. Hlavac, D.D.S., College of Dentistry, New York University, New York, N. Y.

Historical Review of the First Twenty Years of the New York Society of Orthodontists. Joseph D. Eby, D.D.S., New York, N. Y.

Analysis of Malocclusion, Based Upon the Forward Translation Theory. Technique of Correction With the Pin Appliance. George W. Grieve, D.D.S., Toronto, Canada.

Presidential Address. Henry U. Barber, Jr., D.D.S., New York, N. Y.

Director's Report of the Meeting of the A.A.O. Joseph D. Eby, D.D.S., Director, New York, N. Y.

Monday Afternoon:

Correction of Class II Division 1 Case With Bite Plate. Walter A. H. Mosmann, D.D.S., School of Dental and Oral Surgery, Columbia University, North Bergen, N. J.

The Next Twenty Years. Raymond L. Webster, D.M.D., Providence, R. I.

Correction of Severe Mandibular Protrusion by Osteotomy of the Rami and Orthodontia. Benjamin Weiss, D.D.S., Newark, N. J.

Tuesday Morning:

Some Metallurgical Aspects of Orthodontic Materials. Arnold S. Rose, B.S., M.Ch.E., Buffalo, N. Y.

Factors in the Etiology of Malocclusion. Walter J. Sly, D.M.D., Boston, Mass.

Case Report. Adolph Jutkowitz, B.S., D.D.S., College of Dentistry, New York University, New York, N. Y.

Tuesday Afternoon:

The Influence of Moving Deciduous Teeth on the Permanent Successors. Carl Breitner, M.D., School of Dental and Oral Surgery, Columbia University, New York, N. Y.

Clinics:

Supplementing Paper. George W. Grieve, D.D.S., Toronto, Canada.

Pin and Tube Appliance. A. W. McClelland, D.D.S., Montreal, Canada.

Duplication of Orthodontic Casts. Walter R. Bedell, D.D.S., Poughkeepsie, N. Y.

Effect of Correct Heat Treatment on Gold-Platinum Alloy Wire. Frederic T. Murlless, Jr., Hartford, Conn.

Certificates of Proficiency in Orthodontics

Students who have been awarded the Certificate of Proficiency in Orthodontics by Columbia University during the year 1939-1940 are:

Name and Address	*Dental Degree From:*
Dr. Sam Ackerman 505 Melish Avenue Cincinnati, Ohio	Ohio State University

Dr. Louis Colon General Delivery San Juan, Puerto Rico	University of Pennsylvania
Dr. Froilan Gato P. O. Box 521 Key West, Fla.	Atlanta Southern Dental College
Dr. Charles Jonas 101 South Indiana Avenue Atlantic City, N. J.	Baltimore College of Dental Surgery, University of Maryland
Dr. Irving L. Maislen 169 Ridgefield Street Hartford, Conn.	Baltimore College of Dental Surgery, University of Maryland
Dr. Anita Mendel 5775 Durocher Avenue Outremont, Quebec, Canada	McGill University
Dr. Leo Mindel 5 Elm Row New Brunswick, N. J.	Harvard University
Dr. Henry Renedo 80 N.W. Twentieth Street Miami, Fla.	Atlanta Southern Dental College
Dr. Herbert Stollmack 77 Eastern Parkway Brooklyn, N. Y.	New York University

Massachusetts Dental Society

The Massachusetts Dental Society will hold its next annual meeting on April 14-17, 1941, at the Hotel Statler, Boston, Mass. Officers are: President, Dr. George Cowles Brown, 332 Main Street, Worchester, Mass.; Secretary, Dr. Philip E. Adams, 106 Marlborough Street, Boston, Mass.

A. D. A. Convention Exhibit Awards

The following exhibits won awards at the Eighty-Second Convention of the American Dental Association at Cleveland, Ohio, Sept. 9-13, 1940:

Historical Exhibits:

First Award—Maryland State Dental Association
Second Award—University of Pittsburgh, Dental School
Third Award—Northwestern University, Dental School

Scientific Exhibits by Schools and Institutions:

First Award—Western Reserve University, Bolton Fund
Second Award—University of California, College of Dentistry
Third Award—University of Michigan, School of Dentistry, Ralph Sommer, D.D.S.
Honorable Mention—Temple University, School of Dentistry

Scientific Exhibits by Individuals:

First Award—D. B. Waugh, D.D.S.
Second Award—G. M. Dorrance, M.D., and Arthur Dick, M.D.
Third Award—K. E. Taylor, D.D.S.

Health and Educational Exhibits:

First Award—Cleveland Child Health Association
Second Award—Walter E. Briggs, D.D.S.

Third Award—Tennessee State Department of Public Health
Honorable Mention—Missouri State Health Department, Dental Division

Hobby Exhibits:

First Award—Bernie Cooper, D.D.S.
Second Award—Howard A. Hartman, D.D.S.
Third Award—W. M. Goodwin, D.D.S.
Honorable Mention—J. V. Gentilly, D.D.S.

Great Lakes Association of Orthodontists

The Fourteenth Annual Meeting of the Great Lakes Association of Orthodontists was held Oct. 27, 28, and 29, 1940, at the Royal York Hotel, Toronto, Ontario. President Harvey G. Bean presided.

Invocation and Address of Welcome were given by H. J. Cody, M.A., D.D., LL.D., President, University of Toronto, and the response by President-Elect, Dr. Frank S. Cartwright, Detroit, Mich. The papers presented were:

A Case of Distoclusion. Earl H. Teetzel, D.D.S., Detroit, Mich.

A Critical Re-Examination of Certain Orthodontic Conceptions. Allan G. Brodie, D.D.S., M.S., Ph.D., Chicago, Ill.

Familial Factors in the Diagnosis and Treatment of Malocclusion. George R. Moore, D.D.S., Ann Arbor, Mich., and Byron O. Hughes, Ph.D., Ann Arbor, Mich.

A Class II, Division 2 (Angle) Case. C. Edward Martinek, D.D.S., Detroit, Mich.

Malocclusion in Post-Rachitic Adolescence. Bert G. Anderson, M.D., New Haven, Conn.

Medico-Dental Problems, Particularly Those Related to Certain Deficiencies. W. V. Watson, M.D., Toronto.

The Present Status of Vitamin Therapy. F. F. Tisdall, M.D., F.R.C.P. (C), Toronto.

Henry U. Barber, Jr., D.D.S., New York, N. Y., president of the American Association of Orthodontists, and Charles H. M. Williams, D.D.S., B.Sc. (Dent.), Toronto, who gave a travelogue and report of dental study on the Eskimos of the Canadian Arctic, were the annual dinner speakers.

Tuesday a motion picture, "The Edgewise Appliance," was presented by Allan G. Brodie, D.D.S., Chicago, Ill., and the progressive case report table clinics and general clinics were also held. The following papers were given:

The Maintenance of the Health of Oral Tissues. H. K. Box, D.D.S., Ph.D., Toronto.

Myofunctional Treatment From a Practical Standpoint. Alfred P. Rogers, D.D.S., Boston, Mass.

Washington-Baltimore Society of Orthodontists

The next semiannual meeting of the Washington-Baltimore Society of Orthodontists will be held in Baltimore on Dec. 5, 1940. Sessions will open at 9 o'clock in the morning at the Stafford Hotel. Dr. Joseph Johnson will be guest essayist and clinician at both the morning and afternoon sessions. His subject will be: "The Twin Wire Arch: Its Construction and Manipulation in the Treatment of Different Types of Malocclusion." Members of the American Association of Orthodontists are cordially invited.

Notes of Interest

Dr. Carlotta Augusta Hawley announces the opening of her office at 1835 Eye Street, N.W., Washington, D. C. Practice limited to orthodontics.

Dr. David J. Thompson announces the removal of his office for the exclusive practice of orthodontics to 100 Park Avenue, Elmhurst, Ill.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, Henry U. Barber, Jr. - - - - 5 East Fifty-Seventh St., New York, N. Y.
Secretary-Treasurer, Max E. Ernst - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
Public Relations Bureau Director, Dwight Anderson
- - - - - - - - - - - - - - - - - 292 Madison Ave., New York, N. Y.

Central Association of Orthodontists

President, Harold J. Noyes - - - - - - - - - 55 E. Washington St., Chicago, Ill.
Secretary-Treasurer, L. B. Higley - - - - - - - - 705 Summit Ave., Iowa City, Iowa

Great Lakes Society of Orthodontists

President, Frank S. Cartwright - - - - - - - - Henry Ford Hospital, Detroit, Mich.
Secretary-Treasurer, Richard E. Barnes - - - - - - - Republic Bldg., Cleveland, Ohio

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President, I. D. Davis - - - - - - - - - - - - - - 419 Boylston St., Boston, Mass.
Secretary-Treasurer, Edward I. Silver - - - - - - - - 80 Boylston St., Boston, Mass.

New York Society of Orthodontists

President, Glenn F. Young - - - - - - - - - - 745 Fifth Ave., New York, N. Y.
Secretary-Treasurer, William C. Keller - - - - 40 E. Forty-Ninth St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, Will G. Sheffer - - - - - - - - - - Medico Dental Bldg., San Jose, Calif.
Secretary-Treasurer, Earl F. Lussier - - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, A. B. Brusse - - - - - - - - - - - - 1558 Humboldt St., Denver, Colo.
Secretary-Treasurer, Robert L. Gray - - - - - - - - - Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Fred G. Hale - - - - - - - - - - - - Professional Bldg., Raleigh, N. C.
Secretary-Treasurer, T. C. Sparks - - - - - - - - 1508 Washington St., Columbia, S. C.

Southwestern Society of Orthodontists

President, G. C. Turner - - - - - - - - - - - - 406 Myrick Bldg., Lubbock, Texas
Secretary-Treasurer, R. E. Olson - - - - - - - Union Nat'l Bank Bldg., Wichita, Kan.

Washington-Baltimore Society of Orthodontists

President, George M. Anderson - - - - - - - - - - 831 Park Ave., Baltimore, Md.
Secretary-Treasurer, Stephen C. Hopkins - - - - - 1726 Eye St., Washington, D. C.

American Board of Orthodontics

President, Harry E. Kelsey - - - - - - - - - - - 833 Park Ave., Baltimore, Md.
Vice-President, Frederic T. Murlless, Jr. - - - - 43 Farmington Ave., Hartford, Conn.
Secretary, Charles R. Baker - - - - - - - - - - - 636 Church St., Evanston, Ill.
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William E. Flesher - - - - 806 Medical Arts Bldg., Oklahoma City, Okla.
Frederic T. Murlless, Jr. - - - - - - 43 Farmington Ave., Hartford, Conn.
Oliver W. White - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
James D. McCoy - - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.

Foreign Societies†

British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, Harold Chapman

*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.